Root and tuber crops in Central Vietnam: an underestimated potential for food and income?

RESULTS OF A SCOPING STUDY

CIP INTERNATIONAL POTATO CENTER
A CGIAR RESEARCH CENTER

CIAT
International Center for Tropical Agriculture
Since 1967 / Science to cultivate change

CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

IFAD
Investing in rural people

European Commission

FoodSTART +

Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific

Root and tuber crops in Central Vietnam: an underestimated potential for food and income? Results of a scoping study

April 2016

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Abbreviations

CGIAR	Consultative Group for International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
CRP	CGIAR Research Program
DARD	Department of Agriculture and Rural Development
DOH	Department of Health
DOIT	Department of Industry and Trade
DONRE	Department of Natural Resources and Environment
DPI	Department of Planning and Investment
FAO	Food and Agriculture Organization
FGD	focus group discussion
FU	farmers' union
GDP	gross domestic product
GRDP	gross regional domestic product
GSO	General Statistics Office
ha	hectare
HT	Ha Tinh (province)
ICRAF	World Agroforestry Center
IFAD	International Fund for Agricultural Development
kg	kilogram
KII	key informant interview
LDC	least developed country
LMIC	low-middle-income country
MARD	Ministry of Agriculture and Rural Development
mm	millimeter
NGO	non-government organization
NIN	National Institute of Nutrition
PPC	Provincial People's Committee
PRC	Plant Resources Center
QB	Quang Binh (province)
RCRDC	Root Crops Research and Development Center
RTB	Roots, Tubers, and Bananas (CRP)
RTCs	root and tuber crops
SRDP	Sustainable Rural Development for the Poor
TUAF	Thai Nguyen University of Agriculture
USD	US dollar
VAAS	Vietnamese Academy of Agricultural Sciences
VICAS	Vietnamese Cassava Association
VND	Vietnamese dong
WU	women's union

1. INTRODUCTION

1.1. Background

The overall goal of the Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific (FoodSTART+) project is to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region (Philippines, Indonesia, China, India, and Vietnam), through the introduction of RTC innovations, primarily within the framework of IFAD investments. The project objective is to identify gender-responsive needs and opportunities through vulnerability assessments among food-insecure, RTC-producing and -consuming households and to design and implement innovations with partners and local stakeholders that enhance food resilience. Further, the project will develop and validate effective partnership strategies with IFAD investment projects in promoting RTCs for food security at scale. In Vietnam, the project targets are Quang Binh and Ha Tinh provinces, corresponding to the geographic area of the IFAD investment project Sustainable Rural Development for the Poor (SRDP). SRDP's main objective is "investment in climate-smart, socially equitable and profitable rural development models that promote pro-poor market linkages, value chains, and enhanced rural business competitiveness." The approach taken by SRDP is specifically oriented toward consolidation and upscaling of successful innovations through a more rigorous, better capacitated market- and value-chain-oriented approach. The project aims to bridge research and development through an effective partnership between FoodSTART+ and SRDP. FoodSTART+ activities will be designed to complement SRDP activities to ensure that research outputs contribute directly to SRDP targets. FoodSTART+ will also benefit from this collaboration as SRDP may provide additional funds to implement and scale up successful pilots.

1.2. Scoping study objectives

The scoping studies constitute the initial activity of FoodSTART+, contributing to Output 1: 'Subnational geographic target areas combining food vulnerability with significant RTC production and use are prioritized and mapped.' One scoping study was undertaken in each of the five targeted countries. The main objectives of this scoping study are:

a) To collect, collate, and analyze relevant information on root and tuber crop (RTC) production, processing, marketing, and consumption in the target districts covered by SRDP, as well as at provincial and national levels. Attention will be also paid to the role of RTCs in farmers' livelihoods.

b) To collect, collate, and analyze relevant information on diets, food consumption habits, and nutritional status of rural and urban people (distinguishing men, women, and children) in target areas, highlighting the contribution of RTCs to diets and food security.

c) To collect, collate, and analyze additional information from the target area related to the development of climate change scenarios for RTCs.

d) To identify key actors and stakeholders across public, private sectors, and civil society, with whom FoodSTART+ can engage in both action research and policy inputs to improve the contribution of RTCs to food security.

e) To identify key problems and opportunities for attention by FoodSTART+ in the context of partnership with IFAD investment projects and information gaps where further assessments on specific topics are justified.

The findings from this scoping study will be used as a planning tool during the FoodSTART+ inception meeting in February 2016.

1.3. Scoping process and work team

In Vietnam, the scoping study was undertaken between October 2015 and January 2016 in Quang Binh and Ha Tinh provinces, with specific emphasis on SRDP-targeted communes. The team conducted field appraisals in some of the SRDP-targeted communes where RTC production is important. Focus group discussions (FGDs) have been done in six communes (Table 1).

Table 1. Field sites for focus group discussions

Province	Districts	Communes	Province	Districts	Communes
Quang Binh	Quang Ninh	Hien Ninh	Ha Tinh	Cam Xuyen	Can Loc
	Quang Trach	Quang Chau		Nghi Xuan	Xuan My
		Quang Thach			Xuan Lien

Interviews have also been conducted with DARD and RTC value chain stakeholders in other communes and districts, including Dong Hoi and Ha Tinh cities, provincial capitals, as well as Bo Trach (Quang Binh) and Ky Anh (Ha Tinh) districts.

The team was composed of Brice Even, coordinating the study; Nguyen Thi Hieu, assisting in data collection and analysis and providing logistical support; Nozomi Kawarazuka, providing expertise in terms of gender and nutrition aspects; and Clement Bourgoin, in charge of mapping. SRDP staff provided support in organizing the field work, linking with local stakeholders at the district and commune levels and participating

in some of the consultations. SRDP representatives have also actively contributed to the validation workshops held in January.

1.4. Scoping methodology: primary and secondary data collection

The first step of the scoping study consisted of collecting and reviewing the available secondary information on the following issues using both Vietnamese and English: (i) socioeconomic and development context in Quang Binh and Ha Tinh provinces; (ii) biophysical data (soil and climate) and provincial-level land use map; (iii) RTC [1] value chains, including production, processing, marketing, and consumption as well as identification of key players; (iv) nutrition/health data at the provincial level, especially for women and children; (v) previous research and development projects in the area considered; and (v) policy framework relevant to RTCs at national, provincial and local levels as appropriate.

The second step consisted of field appraisals including both key informant interviews (KIIs) and FGDs in order to (i) verify and complete secondary data; (ii) understand trends, opportunities, and challenges for RTC development; and (iii) establish contacts and working relationships for later joint action.

KIIs were conducted with the SRDP team, provincial authorities, and government agencies (including DPI, DARD, DONRE, DOIT, DOH); RTC value chain actors (including smallholders, traders, local processors, and large-scale processing factories) and local NGOs operating in the area. Semi-structured and unstructured questionnaire tools were used (Annex 1), with slight variations according to the type of actor interviewed.

FGDs with farmers have been organized in six communes. Local authorities selected male and female participants as representatives of each village within the commune. The majority of participants were village leaders and leaders of farmers' union (FU) and women's union (WU). We discussed the following themes (Annex 2) with participants by reflecting interests of men's and women's groups, respectively: (i) changes and challenges in RTC production, marketing, and rural processing, and contribution of RTCs to agroecosystems, livelihoods, and food systems; (ii) farmers' experience and response to disasters and extreme weather; (iii) perceptions of food security and of "good" food/diet, changes in household food habits, and the role of RTCs in diets; and (iv) other issues around gender and migration.

[1] This report will focus on cassava and sweetpotato. Potato is not produced while turmeric, canna, aroid, taro, ginger, and other RTCs are grown in Quang Binh and Ha Tinh, but according to local stakeholders, their production is not significant for livelihood and food security. Market potential could be further assessed though.

2. SITUATIONAL ANALYSIS

2.1. National context

Since the introduction of *Đổi Mới* (renovation) in 1986, the Vietnamese economy has sustained a steady economic growth; from 2001 to 2012, GDP growth rate has averaged 6.3%. This has resulted in rapid poverty reduction; the poverty rate decreased from 28.9% in 2002 to 10.7% in 2010[2]. The country has become a low middle-income country (LMIC) since 2008 and has achieved five out of eight millennium development goals by 2010. The GDP proportion of agriculture decreased from more than 40% in 1990 to about 20% in 2011. Although the proportion of the labor force engaged in agriculture also decreased from more than 80% in the 1990s to less than 50% in 2012, the sector maintains an annual growth rate of about 4.5%. The country is now the world's second largest exporter of rice and coffee and is the first exporter of pepper and cashew. Export earnings from agricultural and aquaculture products have grown steadily since 1990, reaching USD 27.5 billion in 2012. The development of agriculture and the rural economy, however, is still comparatively slow and growth is not sustainable in many areas. Agricultural production, furthermore, often has weak links with markets. Poverty in rural areas remains a large, severe, and chronic problem, being concentrated in upland areas in the North East and North West Mountains, parts of the Central Highlands, and the Central Coastal region. The Government's benchmark for rural poverty for 2011-2015 is VND 400,000 (USD 19) per head/month, while the World Bank uses VND 653,000 (USD 36) per head/month. In 2010, the respective rural poverty rates using these benchmarks were 17.4 and 27%, respectively, nationally and 24% and 28.4% in the North Central Coast (IFAD 2013).

Figure 1. Quang Binh and Ha Tinh provinces

[2] Under the new poverty standards, the poverty rate in 2012 was 20.7%.

2.2. Local context

Quang Binh and Ha Tinh are two of the six provinces of the North Central Coast, located between Lao PDR and the East Sea (Fig. 1). Ha Tinh borders Nghe An province in the north. Quang Binh borders Quang Tri province in the south.

2.2.1. Socioeconomic profile and development context

More than 2 million people live in the two targeted provinces. The population of Quang Binh is about 868,000, of which 80% live in rural areas, while that of Ha Tinh is around 1,250,000, of which 84% live in rural areas. Population growth rates are low (under 1% between 2010 and 2013 in Ha Tinh and about 1% in Quang Binh between 2010 and 2015). Population density[3] is far lower in Quang Binh (108 people/km^2) than in Ha Tinh (209 people/km^2; equivalent to the average density in the North Central Coastal area).

Three ethnic groups live in Quang Binh— *Kinh* (nearly 98%); *Chứt* groups (such as *Arem*, *Mã Liềng*, *Sách*, and *Rục*) and *Bru-Vân Kiều* groups (such as *Vân Kiều*, *Ma Coong*, *Khùa* and *Trì*); most of the ethnic minorities live in the mountainous areas of Tuyen Hoa and Minh Hoa districts and in the West of Bo Trach, Quang Ninh and Le Thuy districts. Four ethnic groups live in Ha Tinh (*Kinh*, *Thai*, *Chứt* and *Muong*), with most of the ethnic minorities living in Huong Khe district. The majority, the *Kinh*, dominates communes in SRDP intervention sites where RTC production is high.

In 2014, 7.93% of the households were classified as poor in Quang Binh (QBTV 2015), whereas the percentage of poor households in Ha Tinh was 7.42% (Ha Tinh People's Committee 2014). In SRDP communes, these poverty rates[4] reached an average 49.37% in Quang Binh and 21.27% in Ha Tinh (IFAD 2013). Despite the relatively high poverty rates, Quang Binh and Ha Tinh provinces are under rapid economic development. Poverty rates seem to decrease fast in both provinces.

In Quang Binh, the 2014 GRDP growth was 7.5% (VND 16,307 billion). The value of the agricultural sector (including livestock, fisheries, and forestry) increased by 3.5% between 2013 and 2014, contributing to 20.6% of the GRDP. In 2014, average GRDP per capita was VND 25.3 million per year[5]. The total number of people engaged in agricultural sector is 300,560, about 66.5% of the total labor in Quang Binh province (Quang Binh Portal 2015, GSO 2015, Quang Binh People's Committee 2011).

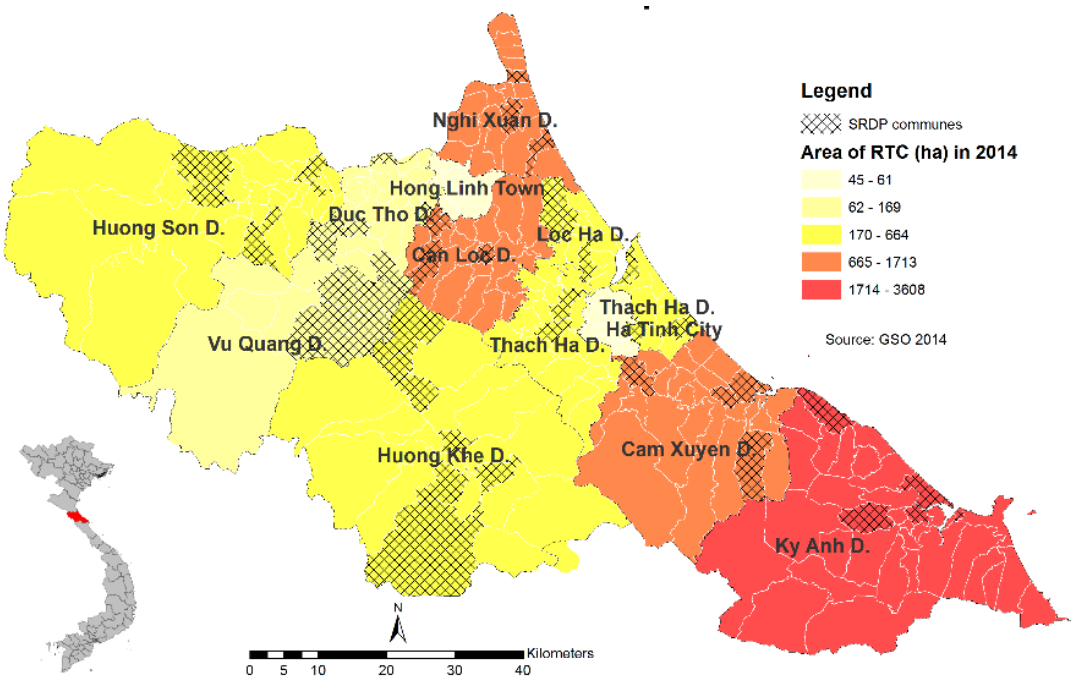
[3] At the national level, population density was 277 people/km^2 in the same year.
[4] These figures are from the end of 2011. When discussing with local authorities at the commune level, the mission was told that these figures are not accurate anymore, but we have not been able to find consistently updated data.
[5] Equivalent to USD 1,100. GDP per capita at the national level was USD 2,052 in the same year (WB 2015).

Ha Tinh province is particularly dynamic. The average GRDP growth was 9.6 % per year between 2006 and 2010, and it reached 14% in 2012 and 19% in 2013. Ha Tinh's GRDP was VND 32,052 billion in 2013. In 2014, average GRDP per capita was 34.894 million (almost 10 million more than in Quang Binh). The last 15 years have focused on the development of industry and services. The value of agricultural sector has more than doubled between 2010 and 2013 (reaching VND 7,288 billion in 2013), but its share of the GDP has actually decreased from 38% in 2008 to 20% in 2014. The total number of people engaged in the agricultural sector is 435,000, about 64% of the total labor in Ha Tinh province (Ha Tinh People's Committee 2012, Ha Tinh Portal 2015).

2.2.2. Mapping of the overlap of the sites of IFAD investment projects and RTC production[6]

In Ha Tinh, SRDP works in 40 communes (Annex 4) over nine rural districts. According to GSO data, both cassava and sweetpotato production areas are concentrated in the four districts of Ky Anh, Nghi Xuan, Cam Xuyen, and Can Loc, (Fig. 2, Table 2). In 2014, total cassava area was 4,082 ha, of which 82% were located in these four districts. The trend was the same for sweetpotato, 62% of the 6,465 ha grown in the province were located in the four districts.

Figure 2. RTC production area in Ha Tinh province



[6] Data on RTC production are not available at the commune level. The most detailed data currently available are at the district level.

Table 2. RTC production area in Ha Tinh province

Root and tuber crop production area in Ha Tinh province (Ha Tinh GSO 2015).						
	Sweetpotato area		Cassava area		Sweetpotato + cassava area	
District	ha	%	ha	%	ha	%
Ky Anh	**1,208**	**19**	**2,400**	**59**	**3,608**	**34**
Nghi Xuan	**1,355**	**21**	**358**	**9**	**1,713**	**16**
Cam Xuyen	**764**	**12**	**352**	**9**	**1,116**	**11**
Can Loc	**698**	**11**	**253**	**6**	**951**	**9**
Thach Ha	604	9	60	1	664	6
Thach Ha	604	9	60	1	664	6
Huong Khe	416	6	126	3	542	5
Huong Son	139	2	305	7	444	4
Loc Ha	400	6	30	1	430	4
Vu Quang	61	1	108	3	169	2
Duc Tho	110	2	30	1	140	1
Hong Linh	61	1	-	0	61	1
Ha Tinh	45	1	-	0	45	0
Total	**6,465**		**4,082**		**10,547**	

In Quang Binh, SRDP intervenes in 50 communes (Annex 3) spread over six rural districts. According to GSO data, RTC production is concentrated in the three districts of Le Thuy, Bo Trach, and Quang Trach, both for cassava and sweetpotato (Fig. 3). In 2014, total area of cassava was 5,794 ha, of which 81% were located in these three districts. The trend was similar for sweetpotato, 74% of the 2,882 ha were in the same three districts.

Figure 3. RTC production area in Quang Binh province

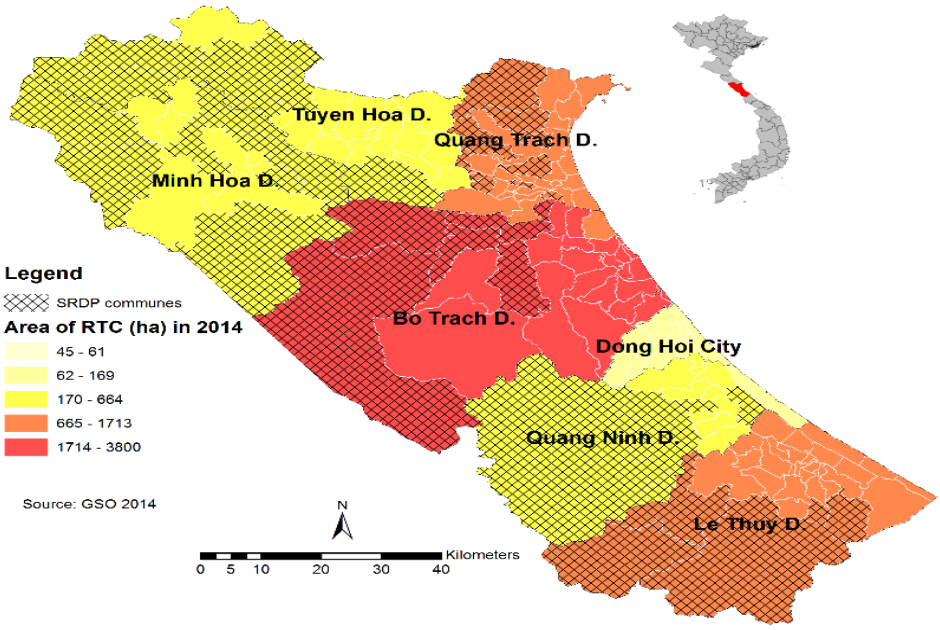


Table 3. RTC production in Quang Binh province

Root and tuber crop production area in Quang Binh province (Quang Binh GSO 2015).						
	Sweetpotato area		Cassava area		Sweetpotato + cassava area	
District	ha	%	ha	%	ha	%
Bo Trach	**435**	**15**	**3278**	**57**	**3713**	**43**
Le Thuy	**820**	**28**	**870**	**15**	**1690**	**19**
Quang Trach	**877**	**30**	**571**	**10**	**1448**	**17**
Tuyen Hoa	330	11	290	5	620	7
Quang Ninh	191	7	403	7	594	7
Minh Hoa	140	5	334	6	474	5
Dong Hoi	89	3	48	1	137	2
Total	**2882**		**5794**		**8676**	

2.2.3. Biophysical soil data and relevant climate data

2.2.3.1. Soil data

According to GSO, Ha Tinh's total area is 599,782 ha. There are two main kinds of soil: mountainous soils, accounting for 69%, and coastal soils, accounting for 28%. Indeed, the province is characterized by a high percentage of highlands (about 400,000 ha; mostly located in the western districts of Huong Khe, Huong Son, Vu Quang, and Ky Anh) with ferralitic soils, which are particularly vulnerable to erosion. Coastal plains (175,000 ha; distributed in Duc Tho, Nghi Xuan, Can Loc, Thach Ha, Cam Xuyen, and Ky Anh districts) include alluvial soils (103,201 ha) and sandy soils (38,222 ha) that are suitable for annual crops. About 65% of Ha Tinh's soils are classified as low- and middle-quality soils and 20% are unsuitable for agriculture (Table 4) (ISPONRE 2009; Monitor Company Group 2012).

Table 4. Types of soil in Ha Tinh province

Soil type	ha	%
Mountainous soil	**402,198**	**69**
Ferralitic soil on high mountain	155,261	27
Yellow-grey ferralitic land on clay stone	148,642	26
Coarse erosive ferralitic soil	34,724	6
Yellow grey ferralitic land on sandstone	27,716	5
Yellow grey ferralitic soil on granite rock, rhyolite soil	29,720	5
Yellow-brown ferralitic on old alluvial material	6,135	1
Coastal plains	**163,828**	**28**
Alluvial soil	103,201	18
Saline and acid sulfate soil	17,265	3
Saline soil	5,140	1
Sandy soil (aerosols)	38,222	7
Intermediary zone with "soils near hills and mountains"	**12,963**	**2**
TOTAL	578,989	100

In Quang Binh, 86% of the land is composed of mountainous soils (among which is a high proportion of grey ferralitic soils – acrisols) and only 14% is coastal soil (half alluvial soils and half sandy soils). There is a large area defined as "non-used" land (about 60,000 ha, equivalent to 7.27% of Quang Binh area) in which 30,000 ha have good potential for agriculture (Quang Binh People's Committee 2011).

Table 5. Types of soil in Quang Binh province

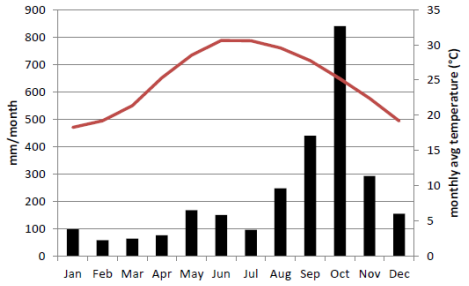
Soil type	ha	%
Mountainous soil	**532,953**	**86**
Grey ferralitic soil (ferralitic acrisols)	458,430	74
Concretion grey soil (ferric acrisols)	21,377	3
Leptosols	24,274	4
Others	28.872	5
Coastal plains	**84,753**	**14**
Alluvial soil (fluvisols)	34,791	6
Sandy soils (arenosols)	37,243	6
Other soils	12,719	2
TOTAL	*617,706*	100

2.2.3.1. Climate data

Rainfall. Both Quang Binh and Ha Tinh have tropical monsoon climate, influenced by the South Asia monsoon (from April to August) and by the East Asia monsoon (from September to November). Annual average rainfall is higher in Ha Tinh—between 2,300 mm and 3,000 mm in Ha Tinh and between 2,000 mm and 2,300 mm in Quang Binh (Fig. 4). Rainy season lasts from April-May to November-December; there is less rain in June and July due to dry and hot winds coming from Laos. The three provincial climate change scenarios predict a slight increase of rainfall (about 1.5-1.8%) by 2020 (Ha Tinh People's Committee 2011). According to the climate change sea level rise scenarios for Vietnam (MONRE 2009), rainfall seasonality and intensity will change; rainfall will decrease during the dry season and will increase during the rainy period.

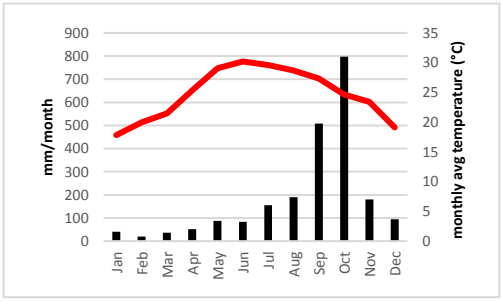
Temperature. The average annual temperature is about 23-25 °C in the lowlands and 14-15 °C in the uplands in both provinces. Warmest temperatures occur in June and July (hot season lasts from April to September), often going beyond 40 °C. Between 1982 and 2011, on average, annual minimum temperatures increased by +0.25 °C/decade (R^2 =0.21); average temperatures, by +0.31 °C/decade (R^2=0.11); and average maximum temperatures, by +0.37 °C/decade (R^2=0.06). (Le VH et al. 2015).

Figure 4.1 Average monthly temperature and rainfall in Ha Tinh province



Average monthly temperature and monthly rainfall in Ha Tinh province between 1982 and 2011. (Based on four automatic weather stations; Le et al. 2015).

Figure 4.2 Average monthly temperature and monthly rainfall in Quang Binh province



Average monthly temperature and monthly rainfall in Quang Binh between 2010 and 2014 (GSO 2015).

Wind. High temperatures are largely due to dry and hot winds coming from the west (Lao wind or *foehn*), mostly from April to August. Ha Tinh reports about 15-22 events a year, generating 30-40 extremely dry and hot days per year, especially in the western districts. The same phenomenon is reported in Quang Binh, a bit later in the year though. These winds, associated with low rainfall, are widely responsible for recurrent droughts that affect cultivated crops, particularly rice.

Droughts. Droughts mostly occur between February and August and result from hot and dry winds combined with low rainfall. ISPONRE (2009) defines drought risk as follows: (i) lower than 5% in February, (ii) between 5% and 25% from March to May, (iii) between 15% and 60% from June to July, and (iv) lower than 30% in August. Dry summers are usual in this North Central Coastal area and are often accompanied by salt intrusion in the coastal plains (through sea water intrusion along the rivers).

Storms. Both provinces are exposed to tropical typhoons, coming from the East Sea and northwest Pacific, mostly between July and October. Over the past 50 years, 18 storms hit Ha Tinh, out of 47 storms affecting the North Central Coast (ISPONRE 2009). Quang Binh was hit by 15 storms between 2003 and 2014, more than one per year (Quang Binh Steering Committee of Disaster Prevention and Rescue 2015). These storms cause heavy rains, flash floods, and even sea water intrusion. Besides the destruction of infrastructure (estimated at USD 150 million from 2000 to 2008 in Ha Tinh and about USD 700 million during 2003-2014 in

Quang Binh), they cause massive destruction of crops and impede the following crop season. These have considerable effects on food security of the rural population.

Floods. Floods usually occur between August and November. On average, two floods are registered every year in Ha Tinh (Le et al. 2015). Between 1958 and 2007, the Ha Tinh city meteorological station recorded 15 days with rainfall more than 300 mm. In the same period, the station registered 14 months with rainfall over 1,000 mm, 4 months over 1,500 mm, 13 months over 3,000 mm, and 1 month over 4,000 mm (ISPONRE 2009). In Quang Binh, a total of 29 floods have been recorded between 2003 and 2014. According to FGDs, flood occurrence has decreased since the 1990s, possibly due to improved infrastructure (river banks, reservoirs) or a reduction of rain and storms.

Farmers' perception is that climate is becoming hotter and dryer. The 2 past years, 2014 and 2015, were rather dry, with extremely high temperatures. This probably contributes to this perception. According to the timeline hazards (Annex 5; made from FGDs, where farmers were asked to mention the extreme climatic events they had in mind), dry episodes are becoming more frequent; since 2010, already two hot/drought events have been reported while they mentioned on average one or two events per decade before 2000.

2.2.4. Provincial-level land use map[7]

Ha Tinh is 600,000 ha, with 81% of the land dedicated to the agricultural sector. Of this, 60% is for forestry (352,000 ha) and 21% is for agriculture (130,000 ha). About 45% of agricultural land is dedicated to rice (55,400 ha). The main crops are rice, maize, peanut, cassava, and sweetpotato (Table 6). Since 2010, the sweetpotato area has significantly decreased (-40%), while cassava area has slightly increased (+15%) (Table 7; Fig. 5).

Table 6. Land use in Ha Tinh province

	Area (ha)	Production (t)
Rice	98,674	479,001
Peanut	17,299	41,067
Vegetables	10,852	60,751
Maize	7,727	26,000
Sweetpotato	6,728	39,410
Cassava	3,666	47,339

Source (Ha Tinh GSO 2015)

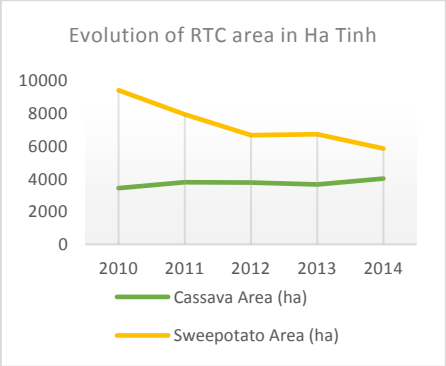
[7] Soil and land-use maps are available at the provincial level (digital files owned by DONRE), but these are not affordable for this project.

Table 7. Changes in land use for RTCs in Ha Tinh province

	Cassava (ha)	Sweetpotato (ha)
2010		9427
2011	3790	7949
2012	3773	6674
2013	3666	6728
2014	4022	5861
2015	ND	ND

Source (Ha Tinh GSO 2015)

Figure 5. Changes in land use for RTCs in Ha Tinh province, 2010-2014



Quang Binh has 806,527 ha and 89% of its land is dedicated to agriculture: 78% is for forestry (630,872 ha) and 10% is for agriculture (82,831 ha). Within the agricultural land, 65% is dedicated to rice cultivation (Table 8). Since 2010, cassava area has remained stable, while sweetpotato area has slightly and regularly been reduced (-10%) (Table 9, Fig. 6).

Table 8. RTC land use in Quang Binh province

	Area (ha)	Production (t)
Rice	54,234	277,471
Maize	4,463	21,404
Sweetpotato	3,732	27,475
Cassava	5,843	108,248

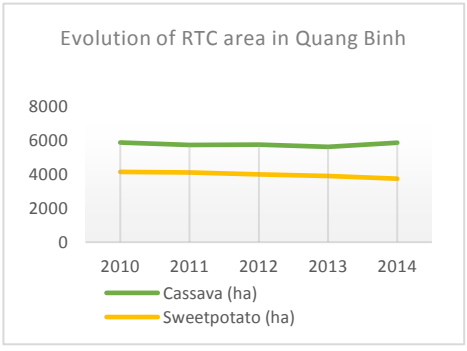
Source (Quang Binh GSO 2015)

Table 9. Changes in land use for RTCs in Quang Binh

	Cassava (ha)	Sweetpotato (ha)
2010	5860	4131
2011	5726	4099
2012	5741	3991
2013	5606	3888
2014	5843	3732
2015	ND	ND

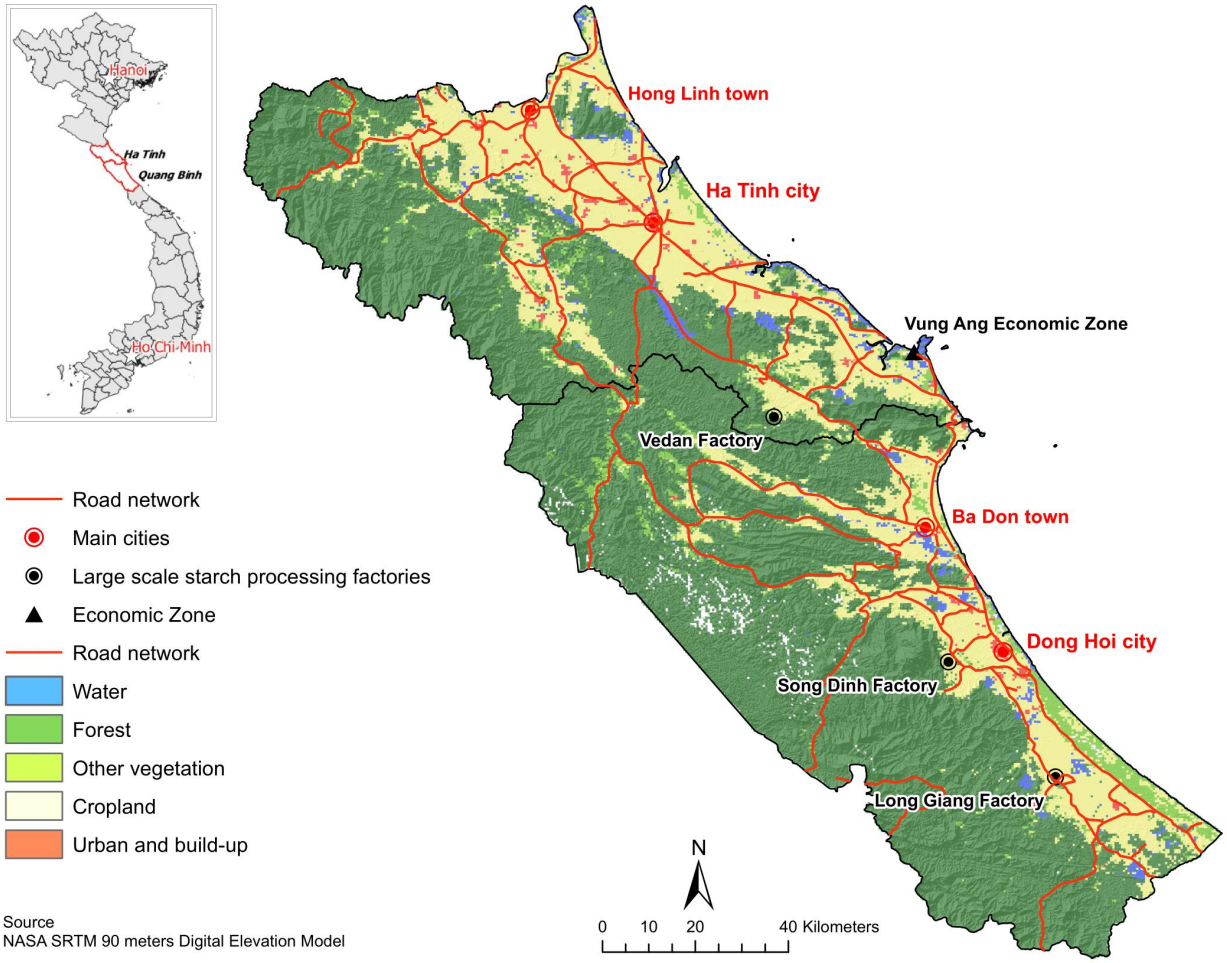
Source (Quang Binh GSO 2015)

Figure 6. Changes in land use for RTCs in Quang Binh province, 2010-2014



The map below gives an overview of land use in both provinces (Fig. 7).

Figure 7. Land use in Ha Tinh and Quang Binh provinces



2.3. General information on root and tuber crops

Tropical RTCs, including cassava, potato, sweetpotato, yams, and aroids, are among the oldest cultivated crops and the second most important set of food crops in the developing world, including Southeast Asia, closely following cereal crops. Hundreds of millions of poor farmers in developing countries use roots and tubers for food security and as an important source of income. Cassava (*Manihot esculenta*) is the second most important food crop (in terms of production) in the least-developed countries (LDCs), and the fourth most important in developing countries, whose total production is 218 million t, more than half of which is in Africa and another third in Asia. Cassava is consumed by some 700 million people today and it is expected to feed more than 2 billion people by 2050. Sweetpotato (*Ipomoea batatas*) is the eighth most important

food crop in developing countries. It has mainly been produced in Asia (110 million t), but production in Africa is increasing. Some sweetpotato cultivars are especially promising, thanks to their high vitamin and mineral contents. Orange-fleshed sweetpotato, in particular, can improve vitamin A intake of children and mothers in rural areas where sweetpotato is consumed almost every day as staple food. Due to their drought tolerance, pest and disease resistance, adaptability to poor soils, and flexible harvesting periods, RTCs significantly contribute to deal with nutrition, poverty, and climate change issues in the developing countries (RTB 2015, FAO 2001, Lebot 2009).

In Vietnam, cassava production increased from 2 million t in 2001 to 10 million t in 2014. Over this period, cassava area has been multiplied by 2.5, from 237,600 ha in 2001 to 560,000 ha in 2014. Vietnam is henceforth one of the main cassava producers and exporters globally, ranking third among cassava-exporting countries, after Thailand and Indonesia. Cassava is the third important crop in terms of surface, after rice and maize. In 2012, export value reached more than USD 1.6 billion. By contrast, sweetpotato area has been divided by 2, from 302,700 ha in 1996 to about 129,900 ha in 2014. Sweetpotato is used locally for human consumption; Vietnamese traditionally eat both vines and roots. Sweetpotato also plays an important role in traditional animal feeding (To 2015, MARD 2014, Tuttle 2012).

2.3.1. Production, area, and yield

2.3.1.1. Cassava

Seasonality. The cassava crop calendars in Ha Tinh and Quang Binh are similar. Planting period is from January to February[8]. In lowlands, farmers harvest cassava earlier than in uplands to avoid crop destruction by the summer flash floods, usually in late August and in September. Cassava in the uplands can be harvested from October to the beginning of January. Harvesting practices also depend on final use of the roots. Farmers harvest cassava from the entire field when they sell roots to factories for processing, while they harvest little by little every day (from August to January) if these are used as livestock feed (Table 10).

[8] Gregorian calendar

*Table 10. Cassava planting calendar in Quang Binh and Ha Tinh provinces**

	1/Feb	2/Mar	3/Apr	4/May	5/Jun	6/Jul	7/Aug	8/Sep	9/Oct	10/Nov	11/Dec	12/Jan
Lowland	Planting						Harvesting	Harvesting	Harvesting			Planting
Upland	Planting								Harvesting	Harvesting	Harvesting	Harvesting / Planting

*Numbers for lunar calendar/letters for Gregorian calendar. Source (FGD 2015)

Varieties. A distinction has to be made between local varieties and what farmers call "high-yielding varieties" (*Sắn Cao Sản* or *Sắn Xanh*). Farmers know the name of the local varieties they grow, but they do not know the names of the improved varieties, although they are widely grown in both provinces. Local varieties are usually used for human consumption and for animal feeding, while the high-yielding varieties are mostly sold to traders/factories, although this is not always clear. The former are perceived "*sweeter and tastier,*" whereas the latter are bitter and contain cyanide, causing "*death of cows and buffaloes when they eat it fresh.*" We identified eight improved varieties and four local varieties grown in the study sites (Table 11).

Table 11. Cassava varieties grown in Quang Binh and Ha Tinh provinces

High-yielding variety - Sắn Cao Sản	Remarks, if any
KM94	Introduced in the area in 1994; most widely spread variety; high yield and high starch content
KM9-94	
KM82	
NA01	New varieties; high yield but low starch content
KM21-12	Only one trial in Quang Binh; great potential
Rayong 72	New varieties, high yield but low starch content
HTL 09	Found in Cam Lac commune. (The Centre for Science and Technology Application describes HTL09 as having higher yield, higher starch content, and better resistance to drought and extreme cold weather than local varieties in Lac Tho Village, Cam Lac Commune, Cam Xuan District).
Sắn Nghĩa Bình	Arrived in the area from southern Vietnam 20 years ago; might be a local variety
Local variety	
Sắn Tộc	
Sắn Trắng (Sắn Quảng)	
Sắn Rau Muống	Mostly in Quang Binh
Sắn Đỏ	Mostly in Ha Tinh

Sources (KIIs and FGDs, 2015)

Among the high-yielding varieties, KM94 is the most popular. Farmers report that "*no variety can replace KM94 because of its high yield and high starch content. There are some new varieties, such as NA01 or Rayong 72, that can give higher yield than KM94, but they have lower starch content.*" However, some trials conducted in Quang Binh in 2014, which compared five different varieties (KM94, KM98-7, Rayong 72, Rayong 9, and KM21-12) have noted great potential in KM21-12, Rayong 9, and Rayong 72. In particular, Rayong 72 was observed to have higher yield and higher starch than KM94 (Fahrney 2015).

According to the information collected during FGDs, we estimate that local varieties represent 20% of cassava areas in Quang Binh and Ha Tinh, while high-yielding varieties represent at least 80%. Local varieties are ordinarily grown in home gardens, whereas improved varieties are grown in "large" fields.

Yields. According to GSO data, cassava yields were 18.5 t ha^{-1} in Quang Binh and 14.5 t ha^{-1} in Ha Tinh (it seems there are some discrepancies in the dataset, as yield differences between districts are huge), which is far lower than yields reported by farmers during the FGDs. According to farmers, there is a huge gap between yields of local varieties (16 t ha^{-1} on average) and improved varieties (36 t ha^{-1}) (Table 12)[9]. The yield difference can be partially explained by production practices, as local varieties (grown in home gardens) seem to not benefit from as much fertilizers than improved varieties (grown in larger fields).

Table 12. Estimated cassava yields (t ha-1) at six communes in Quang Binh and Ha Tinh provinces

	Hien Ninh	Quang Chau	Quang Thach	Cam Lac	Xuan My	Xuan Lien	Average
Local varieties	**ND**	**15**	**15**	**14**	**7**	**30**	**16**
High yielding varieties	40	24	40	50	22	40	36

Source (FGD 2015)

2.3.1.2. Sweetpotato

Seasonality differs according to different criteria, including variety, location, and utilization pattern of the crop. When grown for use as vegetable shoots, sweetpotato is grown in home gardens all-year round. When harvested as roots, farmers usually grow two cycles of sweetpotato; the first one from January-February to April-June and the second from September-October to December-January. Some farmers mentioned that they tend to give up the second cycle of sweetpotato to grow something else more profitable (for instance, peanuts in Ha Tinh). Some others mentioned replacing the second crop of rice by sweetpotato as sweetpotato is more tolerant of droughts and high temperatures (Table 13).

[9] Farmers' estimations are based on the local land unit called "*sào*" (1 *sào* = 500 m^2; in the North Central Coast). This could generate a margin of error bigger than usual and could lead to a significant overestimation of yield per hectare.

*Table 13. Sweetpotato planting calendar in Quang Binh and Ha Tinh provinces**

Commune	1/Feb	2/Mar	3/Apr	4/May	5/Jun	6/Jul	7/Aug	8/Sep	9/Oct	10/Nov	11/Dec	12/Jan
Hien Ninh district (QB)			Harvesting (H)									Planting (P)
	(H)								(P)			
Quang Chau (QB)								(P)			(H)	
Quang Thach (QB)	Sweetpotato is grown the whole year as a vegetable (use of leaves only; roots are not harvested)											
Cam Lac (HT)	Sweetpotato is grown the whole year as a vegetable (use of leaves only; roots are not harvested)											
Xuan My (HT)								(P)				(H)
					(H)							(P)
Xuan Lien (HT)	(P)				(H)			(P)			(H)	

*Numbers for lunar calendar/letters for Gregorian calendar. Source (FGD 2015)

Varieties. Farmers grow both local and improved varieties. Most of the time, farmers have a self-supply of planting material. A wide range of varieties was identified during the FGDs (Table 14). But the information collected is still a bit confusing and would require more investigation. It seems that there is no consistency in the choice of varieties. Farmers face difficulties in finding planting material, thus they have adopted opportunistic strategies and "*they do with what they find.*" Degeneration of varieties was raised in all the discussions. Some productive varieties are abandoned locally because farmers cannot find planting material anymore. For 2 years, there was keen interest for a new variety called "*Khoai Sieu Dot*" (super shoot) that produces abundant and tasty shoots (found in Cam Lac, Quang Chau, Quang Thach, and Hien Ninh communes) (Table 14).

Table 14. Sweetpotato varieties grown in Quang Binh and Ha Tinh provinces

New variety	
Hồng Quảng	New variety from Hanoi Introduced very recently in Cam Lac (HT)
KTB2	Introduced 2 years ago in Xuan My
KTB3 and KTB4	Found in Xuan My: grown in the upland; produces very small roots in the lowland
Khoai Đức Thọ	Red skin, white flesh. super shoot; grown in Xuan My, but they lost the variety because of degeneration and decreasing yield
Khoai Vông	Bigger roots than average; good yield (300 kg *sào*$^{-1}$); tasty; found in Xuan Lien; one crop cycle from January to May
Khoai Vông Mới	Less tasty than Khoai Vong but bigger roots and higher yield (400 kg *sào*$^{-1}$); found in Xuan My; two cycles a year from January to April and from July to October
Khoai Tím	Very tasty but low yield (200 kg *sào*$^{-1}$ = 4 t ha^{-1})
Khoai Nhật	Japanese variety
Local variety	
Khoai Trắng	White skin; found in Quang Thach (mostly grown for shoots and leaves); also grown in Xuan My; seems to be the most widely spread (men FGD)
Khoai Đỏ	Red skin; found in Quang Thach (mostly grown for roots)
Khoai Rau Muống	Found in Quang Thach.; small area and not very popular
Khoai Chiêm dâu	White skin; found in Quang Thach; grown for shoots (food) and leaves/stems (animal feed)
Khoai Hòang Long	Main variety until degeneration becomes too important. Farmers had to stop growing this variety but started again in 2013-2014 with the introduction of new planting material.
Khoai Chiêm Bông	Found in Xuan My; seems to be the most popular (women FGD in Xuan My) while some people say the variety has been abandoned 7-8 years ago (men FGD).
Khoai Bầu Lương	
Khoai Dot Độ	

(Interviews and FGD, 2015)

Yield. Variability of yield (kg of roots per hectare) is high. Farmers reported good yields in areas south of Quang Binh (Hien Ninh district) and north of Ha Tinh (Nghi Xuan). In Cam Lac (center of Ha Tinh province), farmers reported particularly low yields (about 3-5 t ha^{-1}), with very small roots, which could also explain why shoots and leaves are more valued than roots (Table 15). Average yields reported by farmers are about 10.8 t ha^{-1}, which is far higher than yields inferred from GSO data (6.1 t ha^{-1} in Ha Tinh and 7.3 t ha^{-1} in Quang Binh). The Ha Tinh Master Plan target is to reach a yield of 7.5 t ha^{-1}, while that of Quang Binh targets 7 t ha^{-1} by 2020.

Table 15. Sweetpotato yield estimations (t ha^{-1}) in six communes in Quang Binh and Ha Tinh provinces

	Hien Ninh	**Quang Chau**	**Quang Thach**	**Cam Lac**	**Xuan My**	**Xuan Lien**	**Estimated average**
Local variety	16.5	10	4.5	No root	15	8	10.8
New variety	For shoot	10	ND	No root	15	7	10.7

(FGD, 2015)

2.3.2. Crop utilization patterns and trends

2.3.2.1. Cassava

Cassava roots are used for (i) starch production, (ii) animal feeding, and (iii) human consumption. The final use of cassava is closely linked with variety; improved varieties are used generally for starch and animal feeding and low-yielding local varieties are for human consumption. As mentioned before, local varieties are grown on very small surfaces (home gardens). The FGD results indicate that farmers' strategies differ, depending on whether they are in the lowlands or uplands. In the lowlands, farmers have smaller areas (2,000 m^2 per household) and they mostly grow cassava on poor and infertile soils or as an intercrop with peanut, maize, or rubber. Half of cassava roots are sold and the rest are used on the farm for animal feeding (mostly pigs and cattle). In the uplands, farms are bigger and surfaces dedicated to cassava are larger. Eighty percent of cassava roots are sold for starch processing, whereas 20% are used for animal feeding.

Cassava is seen as a cash crop and cassava adoption is highly related to prices offered by starch processing factories (and soil quality). The recent relatively high prices proposed by these factories have encouraged farmers to adopt improved varieties to produce "industrial cassava." In the uplands of Quang Thach commune, several farmers mentioned that "*if cassava market is stable with good prices, we will cut down* Acacia *and* Eucalyptus *plantations to plant cassava.*" As an annual crop, cassava is particularly attractive as it brings cash annually and enables more regular incomes than perennial crops. However, in the lowland, cassava expansion seems to reach an end as farmers want to take advantage of the good quality of the soil to grow more in-demand or more valuable crops such as rice, peanuts, or rubber.

Farmers do not see cassava as a potential crop for feeding the growing livestock sector. For instance, some farmers said, "*We prefer using industrial feed for animals"* and "*We rear a small number of animals in our farms; there are some big farms, but they use industrial feed because it is more convenient and profitable than using cassava."*

2.3.2.2. Sweetpotato

The majority of the producers grow sweetpotato on very small areas (home garden) for home consumption. Shoots and leaves are consumed as vegetables, older leaves and stems are used to feed livestock, and roots are consumed as a snack; surpluses are irregularly sold in local markets. There has been a dramatic decrease in sweetpotato consumption and production in the past 30 years, especially in Ha Tinh. However, it seems that there is a new demand, notably coming from the urban areas. Market prices of

sweetpotato are now relatively high, including those in the local markets, and there is a recent interest among farmers in expanding sweetpotato production as a cash crop.

However, larger areas (about 1 sào or more) of sweetpotato are still grown, specifically in the north of Ha Tinh (Xuan My and Xuan Lien communes) and in the other communes visited. When grown on larger areas, a significant part of the production (roots) is used as animal feed in the farm; surpluses are sold to neighboring farms or (and more and more) local markets for human consumption. In Hien Ninh and Quang Chau communes, farmers use about 50% of the roots to feed their own livestock (the remaining part is mostly sold as food and a smaller amount is kept for home consumption). In Xuan Lien and Xuan My, farmers use about 60-70% of the roots for animal feeding and sell the remaining 30% in local markets. In Cam Lac and Quang Chau, farmers mentioned that they buy sweetpotato roots (as a snack) in the local markets as the roots they produce are too small to be eaten. Except in these two communes, most of the farmers mentioned that current production satisfies domestic needs and that "*an increase in production would be commercialized to get higher incomes.*"

Table 16. Sweetpotato utilization patterns

	Hien Ninh	Quang Chau	Quang Thach	Cam Lac	Xuan My	Xuan Lien
Final use of roots	50% animal feeding 50% human consumption			No roots	60-70% animal feeding 30-40% human food	60-70% animal feeding 30-40% human food
Commercialization rate	10% (local markets)	10% (local markets)	10% (local markets)		20%	20-30%

(FGD, 2015)

2.3.3. Postharvest, processing, and marketing

2.3.3.1. Cassava

Most of the cassava roots are sold fresh to traders. A few farmers interact directly with starch factories. When prices proposed by traders are too low (usually in the middle of the season), some farmers choose to slice and dry roots in order to get cassava chips. Prices for dried cassava are higher (VND 3,000-4,000; ratio is usually 1 kg dried = 3 kg fresh) and more stable than for fresh cassava. Dried cassava chips can also be stored in the farm and used as animal feed.

Price negotiations between farmers and traders are limited. Farmers describe themselves as "price takers" and complain about low prices. Fresh cassava prices fluctuate along the harvesting season (from the end of September until the beginning of February), reaching a low in November-December. Farmgate prices also vary, depending on the commune/district, from VND 900 to 1,400 kg^{-1} of fresh cassava; average price seems to be VND 1,200 kg^{-1}.

Roots from local varieties are harvested gradually and kept for home consumption or sold by women in local markets (VND 10,000-15,000 kg^{-1}). Rarely are these sold to local traders (VND 2,500 kg^{-1}).

Except for sliced and dried cassava for animal feeding, there is no processing done at the farm level. Most of the fresh roots are sent to local, large-scale starch factories, although a significant volume seems to be sent to sweetener factories near Hanoi. Few small-scale processing units produce wet starch, used for making *bánh bột lọc*, a kind of shrimp cake consumed locally as a snack. Further investigation is needed to evaluate the future of this industry, notably in terms of market potential and sustainability.

2.3.3.2. Sweetpotato

Sweetpotato is usually processed on the farm. When used for animal feeding, sweetpotato roots are simply sliced and sun-dried; then it can be stored for a few months.

For home consumption, shoots and leaves are harvested on a daily basis and boiled or fried without any specific process. The same is true for roots, which are usually boiled and eaten as a snack or for breakfast; this is the most common way of preparing it, although not the only one.

Some households process sweetpotato into "*Khoai Gieo*," a kind of dry-and-soft slice of sweetpotato made by a specific sun-drying process that takes 20-30 days, followed by several steps: (i) washing, (ii) boiling, (iii) peeling, (iv) slicing, and (v) sun-drying again. This is done at the household level, before being sold to traders or directly to retailers. This is popular in south Quang Binh; originally it comes from Hai Ninh commune in Quang Ninh district, but processing activities spread around as demand increases. Farmers seem to be not involved in marketing. *Khoai Gieo* is packed in 1-kg plastic-bags and sold to local consumers. Retailers communicate on the origin of the product, south of Quang Binh, and in particular on Hai Ninh commune (supposedly the place with the best *Khoai Gieo*).

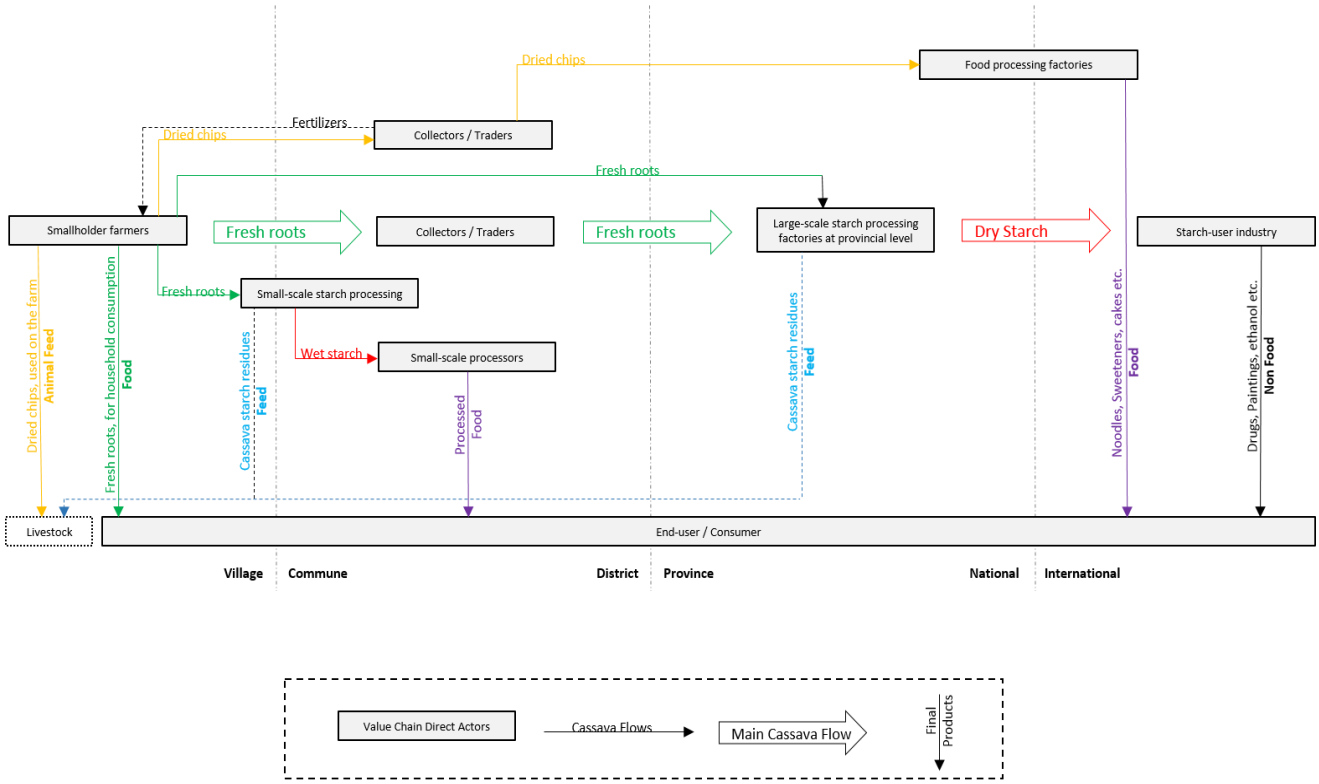
Demand for sweetpotato is growing, not only from urban areas, including Hanoi, but also in local markets. Sweetpotato root prices are relatively high in local markets, ranging from VND 10,000-15,000 (USD 0.50-0.75) for local varieties to VND 15,000-20,000 (USD 0.75-1.00) for imported varieties such as the ones coming from Da Lat. Sweetpotato used to be considered as "*food for poor people"* but is becoming popular among the middle-class, as mentioned by farmers in Xuan My. However, farmers admitted not having access to proper varieties to meet current market opportunities.

2.3.4. Value chain description and key industry players

2.3.4.1. Cassava

Cassava producers are smallholder farmers. They grow local varieties of cassava in very small areas and industrial cassava in larger plots. There is almost no trading for local varieties, and thus no value chain; therefore, the section below mostly covers industrial cassava or what we previously called high-yielding cassava varieties (Fig. 8).

Figure 8. Cassava value chain in Quang Binh and Ha Tinh provinces



Fresh cassava roots are mostly sold by farmers to local traders operating at the commune or district level. Local traders are often local men, working part-time during the harvesting season. Then, traders deliver cassava roots to large-scale factories. Factories process cassava roots into starch before selling these to other industries (mostly through exports to China and Taiwan). Based on the FGD, we estimate that 80% of cassava produced in Quang Binh and Ha Tinh is sold to cassava starch factories.

The relationship between producers and traders is not contractual. There is no commitment from either side regarding quality or prices. Prices fluctuate along the harvesting season, following an inverted "U curve." When purchasing cassava roots, some traders estimate starch content through a visual test and adjust the purchase price according to the results (higher starch content = higher price). Prices are not negotiable and farmers are price takers. In some locations, traders discuss with the head of the village before making a public announcement regarding the purchasing price of the day. Farmgate prices are usually between VND 1,000 and VND 1,400; the lowest price reported was VND 800. Some producers do not have the required labor within the household (or neighboring ones) to harvest cassava themselves. In that case, traders propose to buy the whole field (about 1.0-1.8 million VND per sào; price is discussed according to estimates of yield and starch content for the considered plot), providing harvesting services. Both sides seem to dislike this way of trading. Farmers complain because they cannot keep stakes as planting materials for the next season, the harvesters do not take care of the soil when pulling cassava plants, and they take risk as purchasing price is set before harvest. Traders are also dissatisfied as it requires more logistics and involves more risk. One trader explained that she purchases an entire plot of land to prevent farmers from harvesting too early (because of rains); she buys cassava at lower prices than the others who buy cassava harvested by farmers, but, in some ways, she covers the risk for farmers who will be paid regardless of yield and quality.

Three cassava starch factories operate in the two provinces—Long Giang and Song Dinh in Quang Binh province and Vedan in Ha Tinh province. They operate 6 months a year, processing between 300 and 400 t day^{-1} each. Purchasing prices at the factories are defined on a daily basis and are indexed on starch content. In 2014/2015, prices of cassava roots fluctuated between VND 1,400 and VND 1,850. They mostly source cassava not only from Quang Binh (in particular, Bo Trach district) and Ha Tinh (Ky Anh district) but also from neighboring provinces Nghe An in the north and Quang Tri in the south. Factories compete in buying cassava and have implemented strategies to secure their cassava supply. However, there is little or no incentive for bulk buying.

Vedan was established in 2008 in Ky Anh district. The factory processes 360 t a day (50% of design capacity), mostly KM94 and KM994. It works mostly with farmers (80% of supply) and traders to a lesser extent (20%). They do not sign contracts anymore with suppliers, most likely to avoid paying for transport. The sourcing team (10 people) works closely with DARD extension staff and provides technical support to farmers (especially to newcomers who are given planting materials in the first few years). There is no coordination during harvest time, "*the system is auto-regulated,*" which generates a "traffic-jam" at the factory gate during peak season (some trucks have to wait 3 days to unload cassava roots; this affects negatively the starch content of the roots (establishing a rotating harvest system to ensure a steady flow of inputs should be

considered). The factory will close at the end of the 2015/2016 season. The reasons for closing are not clear, but it appears to be because of very low profits. Farmers have been advised that the factory will not buy cassava roots in 2016/2017. The factory might be bought though and it can restart processing activities later on.

Long Giang was established in 2010 in Quang Ninh district. The factory processes 300 t of fresh cassava roots per day. It has also processed canna (since 2011), kudzu, and turmeric (since last year); it represents less than 5% of total production. Seventy percent of cassava fresh root supply comes from 20 traders; the rest is sourced directly from farmers. The factory signs contracts with traders, collaborative farmer groups, and army programs. For instance, they signed a contract with the army in Truong Son commune, which provides monetary support to ethnic communities for planting cassava; the factory gets exclusive rights to buy cassava and engages in buying the whole production of the considered area. However, all contracts seem to be verbal and based on trust. Contracts are often broken, notably due to price volatility, thus leading to a side selling phenomenon. The Long Giang director reported that "*fluctuation of international starch prices makes it difficult to establish contracts with farmers.*" The Long Giang factory exports 80% of its production and is highly vulnerable to price instability. The domestic market is more stable, but delayed payment of clients is an issue.

The Song Dinh factory was established in 2004 in Bo Trach district. The factory processes 400 t of fresh roots of cassava per day (90% KM94 and 10% of NA01, KM21-12, Rayong 72, and local varieties) and operates 7 months a year. Cassava is mainly sourced from Bo Trach (80%) and from other Quang Binh districts. They source cassava in Ha Tinh and Quang Tri at the beginning and end of the harvesting season. They work with farmers and traders. Contracts are signed with some traders. Recently, supply contracts have been signed with five communes (Nam Trach, Dai Trach, Tay Trach, Xuan Trach, and Viet Trung) through representatives of the local farmer union, but informal relationships remain in the mainstream. Starch is sold through FOCO, the parent company.

Competition in sourcing cassava has been a big issue between factories for many years. Recently, Quang Binh authorities, in collaboration with Long Giang and Song Dinh factories, have demarcated proper supply areas for each factory. The north of Quang Binh province is the supply area for Song Dinh, while the south is for Long Giang. Despite this, factories are still in conflict as traders can easily move material from one district to another. Market mechanisms operate, even if factories have tried to reach a common agreement on purchase prices.

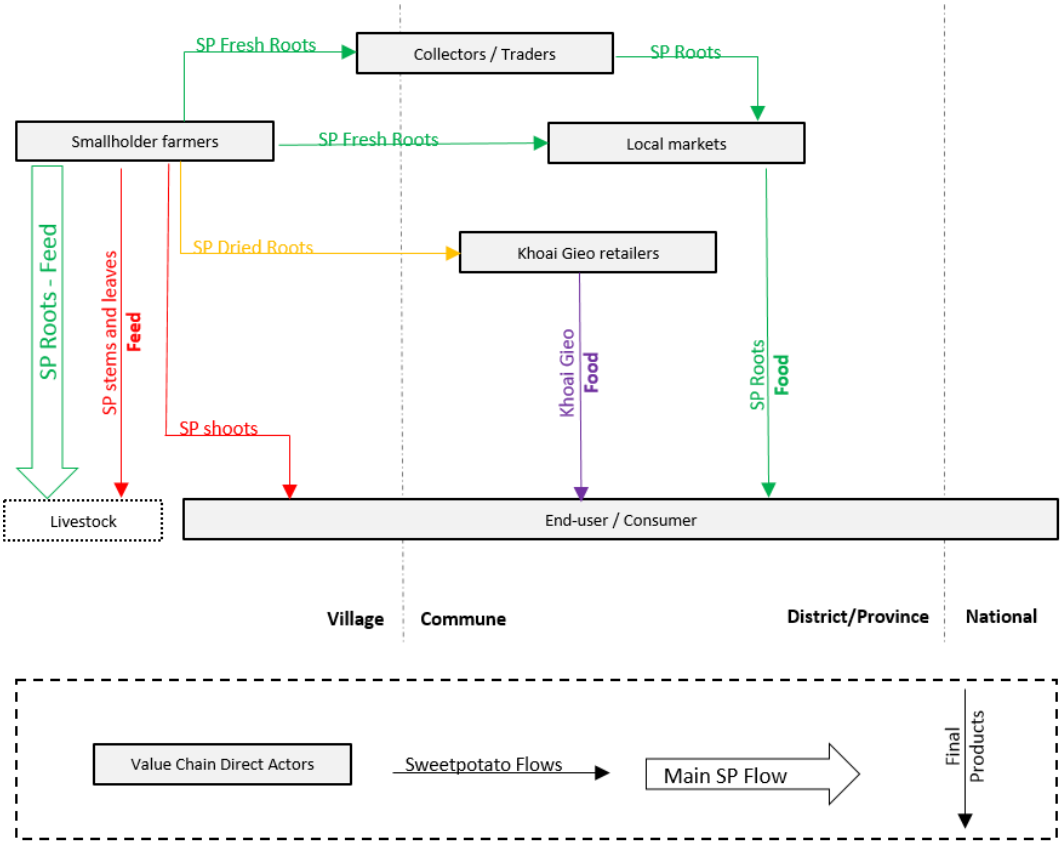
Dried cassava is also traded, although it seems to be mainly used on farm for feeding livestock. Local traders work with a "big man" in Hanoi, who apparently purchases the whole production coming from Ha

Tinh and Quang Binh to supply several factories (mainly sweeteners) operating around Hanoi[10]. Last year, prices were around VND 4,000 at the farm gate and reached VND 6,000-6,500 at the factory-gate.

2.3.4.2. *Sweetpotato*

In comparison with cassava, **the sweetpotato value chain is simpler and involves fewer actors**. Most of the farmers rely on self-supply for planting material, they buy fertilizers/pesticides in the local shops. The geographic scope is also narrower; most of the sweetpotato produced is consumed locally, within the commune for shoots and leaves and within the district for roots (Fig. 9).

Figure 9. Sweetpotato value chain in Quang Binh and Ha Tinh provinces



Only processed products, such as *Khoai Gieo*, reach the provincial and national levels. In the past, *Khoai Gieo* retail shops were mostly located in Dong Hoi city, but other retailers have recently opened in Hanoi and Da Nang. According to a small-scale *Khoai Gieo* retail business selling 10 tons a year in Dong Hoi city, sales are

[10] About 10 years ago, dried cassava was transported to China for bioethanol production, but this has not been mentioned at any point by the VC actors met by the mission.

increasing rapidly due to growing demand from urban consumers. The process is done in the farm, except for the last step that consists of rehydrating the product before selling to end-consumers (in order to make it softer). This is done by retailers.

Fresh roots are largely used on farm for feeding livestock (about 50% of production in Hien Ninh and Quang Chau and 60-70% in Xuan My and Xuan Lien). Farmers sell the remaining quantity to traders or directly in the closest local markets. Relationships with traders are informal; in most cases, women sell them individually in local markets to get better prices, but it is time consuming and not always possible. Selling strategies are opportunistic, according to the remaining quantities after feeding their own livestock. Women said, *"when we need money to buy other stuff, we bring and sell sweetpotato at the local markets."* Farmers do not buy sweetpotato as feed because they have enough to feed their own livestock. They do not sell sweetpotato as animal feed. All farmers are self-sufficient and the industrial livestock farms rely on maize and imported feed. Farmers say that they are not yet interested in sweetpotato as animal feed, in spite of its potential. Further investigation should be done on the potential of animal feed factories buying dried sweetpotato and cassava for incorporation into commercial feed rations.

2.4. RTC for food security, nutrition, and livelihoods

2.4.1. Diets and food consumption habits

Vietnam has a rice-based diet. Roots and tubers are not included in everyday meals, although sweetpotato and cassava have, historically, been important crops for small-scale farmers. Most farmers reported that, until the mid-90s, around 50% of the total farming area was allocated to sweetpotato; frequently consumed as an alternative source of staple food, substituting for rice during seasonal shortages. However, since rice production has dramatically increased, farmers no longer depend on sweetpotato and cassava roots as the staple. For the interviewed famers, this increasing rice availability is strongly associated with the end of hunger gaps, indicating that, in this context, **food security is closely associated with rice rather than with roots and tubers**. However, roots and tubers remain important crops for the household's food security, especially in terms of food access. One woman from Xuan My commune emphasized that, even if the contribution to food security and livelihood was not direct, given that RTCs are not eaten, they are still important in their livelihood systems, providing animal feed (e.g., for fish, pigs, and buffalo). RTCs contribute to generating cash income from livestock and to improving the quality and diversity of farmers' diet.

Leaves and vines from sweetpotato remain one of the most frequently consumed and favored green vegetables together with other leafy vegetables such as *rau cải* (Chinese cabbage), *rau muống* (morning glory), and *rau cải bắp* (cabbage). This is an important issue because, in the Vietnamese context, green

vegetables are highly valued and considered an essential dish for each meal. They are grown in almost every home garden in Quang Binh and Ha Tinh, and farmers rarely purchase vegetables from the market, except in summer, when it is too hot to grow vegetables. Food safety concerns about use of pesticides for growing vegetables is increasing among consumers (not only the better-off consumers) and further investigation on this could be done.

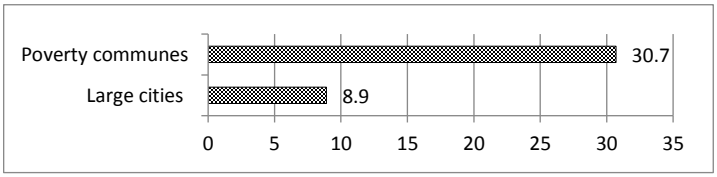
Although cassava is mainly planted as a source of income (through cassava starch industry) and for animal feed, it is still grown for human consumption. Xuan Lien commune in Ha Tinh is well known for this; local people estimate that approximately 5% of the total agricultural land is used for cassava for food. Farmers claim their "*cassavas are the tastiest"* in Vietnam and, as such, cassava consumption is higher than in other districts. Both men and women, and from children to the elderly, consume them every day during the high season, between July and November. In this period, some women boil and sell them in the neighboring towns' markets, reflecting the low but stable demand for cassava from urban consumers, who eat them as a snack.

2.4.2. Nutritional status of rural and urban folks

Nutritional status of children in Vietnam has dramatically improved over the past 15 years. However, the prevalence of stunting remains relatively high, affecting 25.9% of children under 5 years old (NIN 2013). Quang Binh and Ha Tinh are among the 14 provinces (out of 64) with a high prevalence of stunting, affecting respectively, 30.8% and 30.7% of the children.

However, the averages at national and provincial levels can hide the real challenges of undernutrition for the small number of marginalized populations. In Vietnam, the nutritional status gap is large between the Kinh majority and other ethnic minorities, as well as between rural and urban areas. For example, stunting affects more than 50% of some ethnic minorities compared with 23.2% of the Kinh majority. The gap in stunting rate between urban and rural areas is also wide. The average rate in large cities is only 8.9%, while that in the poor communes in rural areas is 30.7% (Fig. 10). In this respect, further detailed information is needed to address specific issues faced by the targeted population.

Figure 10. The prevalence of stunting children under 5 years old

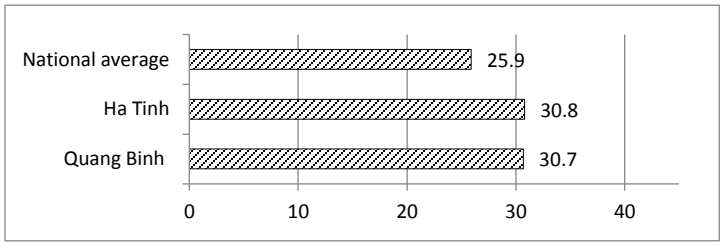


Source (Government of Vietnam 2012)

Vitamin A deficiency (retinol < 0.7mmol L^{-1}) is now at subclinical levels. In 2010, the prevalence was 14.2% among children under five and 35% among lactating mothers. The government addresses this issue by distributing high-dose vitamin A capsules. At the national level, around half of the mothers receive vitamin A supplements. In Quang Binh and Ha Tinh, this rate is lower, 32.6% and 39.7%, respectively, of mothers taking vitamin A supplements (MoH/NIN 2010). Apart from supplementation, the Ministry of Health promotes fortified food such as fish, condiments, and oil to reduce Vitamin A deficiency.

One of the key challenges identified by the Ministry of Health is chronic energy deficiency among young mothers with children under 5 years, which has persisted in the country over decades with very slow improvement. In 2010, the average national prevalence of chronic energy deficiency was 17.2% (male 15.5% and female 18.5%). The rate for young mothers (ages 15-19) was particularly high in both Quang Binh and Ha Thin (Fig. 11). Since early marriages are not uncommon in rural areas and the mothers' nutritional status significantly affects the health of their newborns, agricultural interventions for household food security need to carefully consider young mothers' labor burdens in agriculture. The underlying role of gendered power relations in the distribution and redistribution processes within the family and community, in which young mothers and their children may benefit less from agricultural interventions, has to be also taken into account.

Figure 11. The prevalence of chronic energy deficiency



Source (NIN 2013)

2.4.3. Environmental and socioeconomic vulnerability factors

Climate is considered a major vulnerability factor by farmers. In Quang Binh, farmers attribute their low income, in comparison with those in the northern and southern provinces, to climate. The recrudescence of drought and increasing temperatures lead to more vulnerability. In Quang Chau, for instance, farming strategies largely rely on rice (for home consumption, and therefore household food security) and maize (as a cash crop), both vulnerable to droughts, so farmer exposure to risk is increased. Farmers seem to be aware of that, but, so far, they still prefer growing maize to RTC, maximizing potential profit instead of reducing risk.

Farmers have to face erosion and degradation of soils, especially in mountainous areas where ferralitic soils degrade quickly with the decrease of forest coverage. In addition, farmers do not always take into account proper soil management practices to maintain fertility. After a few years of cropping without adequate practices, yields decline, as well as income. Farmers abandon their fields and have to cut more forest to access fertile land.

Biological factors do not seem to be an issue yet for RTC cultivation. However, pests and diseases start to appear in both provinces. Witches broom has been noticed in few cassava fields in Nghi Xuan; farmers did not know it was a disease.

2.5. Other relevant information

2.5.1. Previous projects in the target region

Table 17. Previous projects in Quang Binh and Ha Tinh provinces

Project name/years	Project implementer/ funder	Project overview
National projects		
DPRPR - Decentralized Programme for Rural Poverty Reduction in Quang Binh/2005-2012	PPC Quang Binh/IFAD	The main objective was to improve the socioeconomic condition of poor rural households, improving food security and living standards, strengthening grassroots organizations and producers' skills and stimulating the integration of decentralized development approaches at the provincial level.
IMPP - Improving Market Participation of the Poor in Ha Tinh/2006-2012	DPI Ha Tinh/IFAD	With the main objective of increasing income of poor rural households by strengthening their access and involvement into various markets, the program has put in place successful integrated approaches for the development of new businesses, strengthening of PPP, and the design of market-oriented socioeconomic development planning.
Improving the community's adaptability and response to climate change in Ha Tinh province/2014-2016	DONRE Ha Tinh/ APHEDA	The project will develop and conduct media activities, raise awareness of environmental protection and climate change for selected groups and vulnerable coastal communities. Forecasting and warning of the impact of climate change will be strengthened.

Applying science and technology advances on building new cassava varieties (HTL-09) model in Cam Lac commune	CSTA/DoST Ha Tinh	The project introduced HTL-09 variety in Cam Lac, Cam Xuyen district and compared this variety with other local varieties in terms of adaptability to local conditions, yield, starch content and profit; then supported farmers to make decision on the choice of cassava varieties (CSTA 2013).
Vietnam Natural Hazard Management Project	Ha Tinh and Quang Binh PPC/World Bank	Objectives of the project were to (i) strengthen capacity of natural disaster risk management agencies at the national, provincial, and district levels; (ii) enhance early natural disaster forecast and warning systems; (iii) build capacity at communal and village levels; (iv) mitigate natural disaster risks; (v) improve capacity of project management and implementation, environmental and social management in integrated management of natural disasters.
Poverty Reduction Project in Central Vietnam/2004-2009	DFID Quang Binh/ADB	Main objective was to ensure stable, long-term food security for families; increase incomes of the poor through increased agricultural productivity and create incremental revenue opportunities from non-agricultural activities with support from the supply of microfinance and infrastructure development to increase access to markets and increased agricultural productivity for the people in project areas.
Ha Tinh Agricultural Development Project/2011-2015	Ha Tinh DARD/ CIDA	The project is implemented in 13 communes in the districts of Thach Ha, Ky Anh, and Duc Tho with three components: (I) implementation of agricultural and rural development plan, (ii) development of small-scale infrastructure projects to support agricultural and rural development, and (iii) capacity building for agricultural and rural development project management.
International projects		
4FGF - Food, Feed, Fuel, and Fiber for a Greener Future/ 2009-2013	CIAT, CIP, VAAS, and other national research institutions/IFAD	Main objective was to improve the livelihoods of smallholder farmers by promoting integrated crop-livestock systems and by better linking these with agro-industrial processing in Cambodia, Laos, and Vietnam (including Quang Binh). In Quang Binh, the project worked with a large-scale cassava dry starch factory and a feed-processing company to demonstrate

		improved livestock feeding practices to farmers.
IBC – Inclusive Business Models to promote sustainable smallholder cassava production/2013-2014	SNV, CIAT/IFAD	The main goal was to improve income security and livelihoods of smallholder producers by improving the productivity and sustainability of cassava production and creating profitable relationships with processors in Laos, Cambodia, and Vietnam (including Ha Tinh).
Unknown/2009-2011	SNV/Ford Foundation	The aim of the project was to increase the income of poor rural households within the cassava and acacia value chains in three provinces: Thua-Thien-Hue, Quang Tri, and Quang Binh. The project initiated contract farming between producers and processing factories.
Smart Tree-Invest/2014-2017	ICRAF/IFAD, FTA	Implemented in Huong Khe district, Ha Tinh and Tuyen Hoa district, Quang Binh, the project aims to improve the livelihoods and resilience of smallholder farmers in the face of climate change, focusing on improving farming practices of farmers and finding co-investment in the environmental services they provide.
Improving the community's adaptability and response to climate change in Ha Tinh province/2014-2016	DONRE Ha Tinh/APHEDA	The project will develop and conduct media activities and raise awareness of environmental protection and climate change for selected groups and vulnerable coastal communities. Forecasting and warning of the impact of climate change will be strengthened.
Recovering after storm and building capacity on community-based natural hazard management and prevention/2012-2014	Caritas, Challenge to Change/Quang Binh PPC	The overall goal of the project is to rehabilitate houses, build community shelters and develop capacity for disaster risk management as a model of good practice in the central region of Vietnam. New disaster-resistant houses have been built (or repaired), applying disaster-resistant models. Local stakeholders received training on Community Based Disaster Risk Management and Climate Change Adaptation.
Support and Development of Livelihood for Poor Farmer Households in Minh Hoa District/2011-2013	Quang Binh Red Cross/Monsanto Foundation	The project aimed to improve living standards and livelihoods of vulnerable rural households in Minh Hoa (Quang Binh), and other provinces.

2.5.2. Policy environment relevant to RTCs

At the national level, although cassava is a major crop (in terms of area, labor, and export), there is no specific plan for supporting cassava or any other RTC. Moreover, Decision No. 124/QĐ-TTg, issued on 2 February 2012 by the prime minister and approving the master plan for the development of agricultural production to 2020 (and vision to 2030) and Decision No.824/QĐ-BNN-TT, issued on 16 April 2013, by the minister of agriculture and approving the crop sector development until 2020 (and vision to 2030) show the **willingness of the government to limit the expansion of cassava**. The decision aims to "stabilize" cassava area at 450,000 ha in 2020 (cassava area was already nearly 550,000 ha at the issuance date of the directive) and to increase cassava contribution to animal feed and bio-ethanol production. The role of cassava in bioethanol production is also mentioned in Decision No.177/2007/QĐ –TTg issued on 20 November 2017 by the prime minister and approving the proposal for biofuel development to 2015 (and vision to 2025).

Directive 1140/CT-BNN-TT issued on 28 April 2008 by MARD on sustainable development of coffee, rubber, and cassava also expresses the **willingness to limit cassava expansion**, especially on sloping land.

Decision No. 62/2013/QĐ-TTg issued on 25 October 2013 by the prime minister encourages vertical integration of the agricultural sector through the **strengthening of linkages among value chains** (e.g., contract farming) and the reorganization of agricultural land (i.e., larger fields and larger farms) to increase the competitiveness of the agricultural sector. Decree No 210/2013/ND-CP issued on 9 December 2013 by the prime minister encourages public and private companies to invest in agriculture and the rural area. In particular, Article 14 encourages investments on infrastructure related to drying rice, maize, sweetpotato, cassava, and other crops; Article 16 points out the necessary support to agricultural production as well as storage and processing activities.

Decision 3391/QĐ-BKHCN issued on 8 December 2014 by the Ministry of Science and Technology on National Standard (TCVN) 10546:2014 provides the organoleptic and physicochemical indicator requirements for cassava starch.

RTCs are not part of the national strategy for improving nutrition and health. Decision 2824/QĐ-BYT issued on 30 July 2007 by the Ministry of Health mentions RTCs (potato, sweetpotato, taro and yam) as food supplement in their recommended nutrition table.

At the provincial level, the master plans for the development of agricultural production to 2020 (and vision to 2050) mention an increase of cassava and sweetpotato areas. In Quang Binh, cassava and sweetpotato

areas are expected to reach, respectively, 6,500 ha (current area 5,800 ha) and 4,200 ha (current area 3,700 ha) by 2020. In Ha Tinh, cassava and sweetpotato areas are expected to reach, respectively, 7,015 ha (current area 4,000 ha[11]) and 5,000 ha (current area 5,800 ha) by 2020 (Ha Tinh DARD 2012).

In Ha Tinh, Decision No.37/2013/QĐ-UBND, Decision No.62/2014/QĐ-UBND, and Decision No.67/2014/QĐ-UBND issued by the Provincial People's Committee (PPC) aim at giving a framework for supporting the agricultural sector but there is no mention of RTCs.

In Quang Binh, Decision 2628/2014/QĐ-UBND issued by the PPC and approving the development plan for economic cooperation in the agricultural sector (2014-2020) encourages the creation of large-field farms for cassava and other crops. Decision No13/2015/QĐ-UBND, Decision No 18/2014/QĐ-UBND, and Decision No. 242/2009/QĐ-UBND issued by the PPC encourage sustainable practices in terms of production and processing, especially in the uplands, but there is no direct mention of RTCs.

Despite the agricultural master plans mentioning an increase in cassava and sweetpotato areas, local authorities do not support RTC expansion. Neither cassava nor sweetpotato are seen as staple food and therefore are not considered strategic crops to achieve food security. Moreover, due to improper practices, cassava cultivation is considered an environmental threat with respect to soil degradation, deforestation, and river pollution (from effluents of processing factories). As explained by Ky Anh DARD director, "*we do not encourage cassava industrial processing at the locality because of environmental problems.*"

RTCs are not included in the targeted crop value chains to be supported by SRDP project activities.

However, some districts prioritized RTCs as *flagship* programs. For instance, Decision 2455/QĐ-UBND issued on 25 November 2015 by the Nghi Xuan People's Committee plan to expand sweetpotato area to 1,470 ha (1,406 ha in 2015), in particular, in Xuan Vien, Co Dam, Xuan Thanh, and Xuan My communes, with a total production of 10,647 t. The decision does not mention any other RTCs.

In Ky Anh district, local authorities plan to reach a sweetpotato area of 700 ha (625 ha in 2015) for an expected total production of 4,665 t. They also plan a total cassava area of 1,800 ha (2,161 ha in 2015) despite the closure of the Vedan starch factory, for a total expected production of 40,350 t.

[11] These provincial master plans expect an increase in cassava area, which is inconsistent, given that the relevant national and local authorities do not encourage the expansion of cassava.

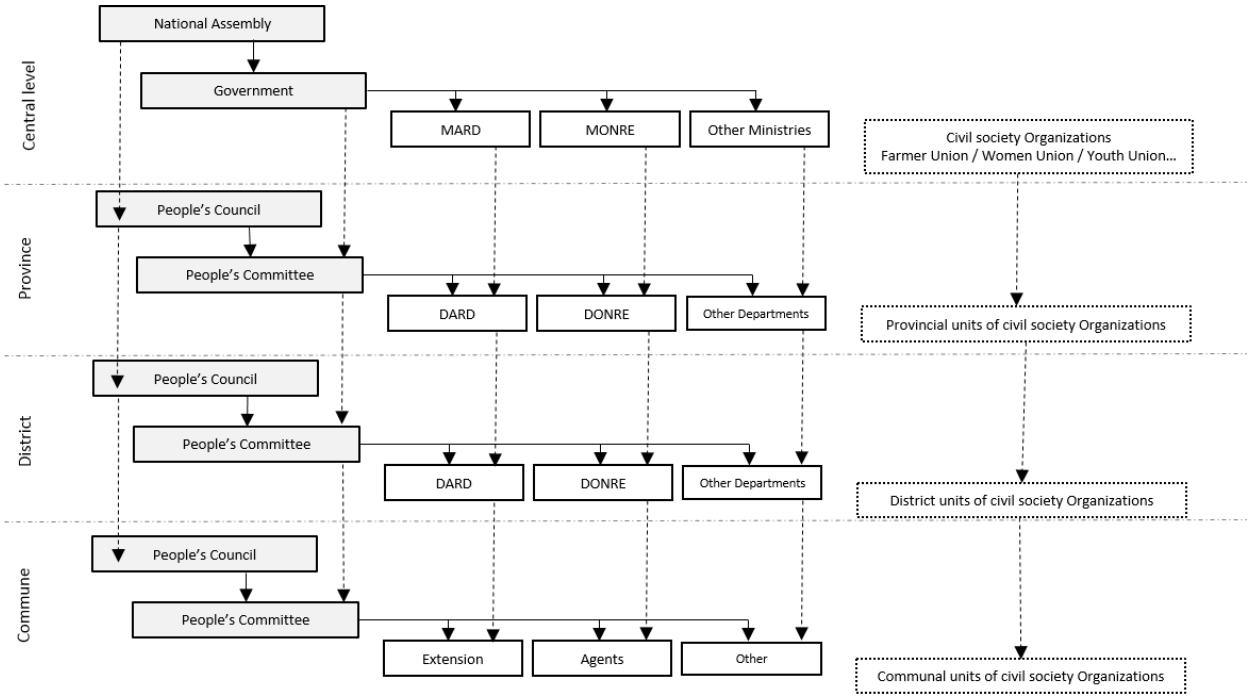
3. STAKEHOLDER ANALYSIS

3.1. Government agencies

3.1.1. Policy institutions

Vietnamese government agencies are present at all levels, from national to village (Fig. 12). The ministries and their related agencies report to the Communist Party and its People's Committee units.

Figure 12. The government structure in Vietnam



In theory, the people's councils are the highest authority at the provincial level. They appoint the PPC members who take charge of formulating and implementing policies. SRDP Quang Binh is implemented by the PPC. At the district and commune levels, extension stations are under the responsibility of PPC; it is one of the key structures to disseminate science and ensure capacity building at the farm level.

The Ministry of Planning and Investment (MPI) is in charge of planning and development investment, including the provision of general advice on strategies and plans for national socioeconomic development. MPI is also in charge of managing the Official Development Assistance (ODA) and foreign non-governmental

aid. It is considered one of the most powerful ministries in Vietnam. SRDP Ha Tinh is implemented by the Department of Planning and Investment (DPI).

The Ministry of Agriculture and Rural Development (MARD) is responsible for agricultural affairs at the national level. At the provincial level, DARD is responsible for defining the rural development strategy and implementing projects related to agriculture and natural resource management; in the considered provinces, DARD did not prioritize RTCs and it is not directly in charge of SRDP implementation.

The Ministry of Natural Resources and Environment (MONRE) is mainly responsible for implementing the national policy regarding land use and natural resource management. MONRE is also in charge of meteorology and climate issues, as well as mapping and remote sensing. DONRE have provincial maps on soil and land use, but these are not freely available. DONRE is also responsible for building, implementing, and updating action plans for climate change adaptation as well as conducting national programs in relation to climate change adaptation and mitigation. Vietnam's Institute of Meteorology, Hydrology, and Environment (IMHEN), under MONRE, conducts academic research and develop technology on meteorology, hydrology, and climate change.

The Ministry of Industry and Trade (MOIT) is in charge of many domains, including the food industry and other processing industries, import and export, cross-border trade, and other market-related issues. At the provincial level, DOIT is responsible for managing the processing factories, but DOIT's collaboration with large-scale cassava starch factories seems to be limited to quantitative data collection (e.g., volume of production, volumes exported, etc.) for provincial statistics.

The Ministry of Health (MOH) is responsible for nutrition and health issues. At the provincial level, it runs different programs regarding nutrition improvement but nothing related to RTCs yet.

3.1.2. National research centers

The **Root Crops Research and Development Centre** (RCRDC), under the **Food Crop Research Institute** (FCRI), carries out research on RTC production and processing. RCRDC has notably worked on cassava (varieties Rayong 9, Sa 21-12, KM98-7), sweetpotato (varieties KLC3, KLC266, KL5, VĐ1, KB1), canna (DR1), and potato (Eben and Sinora). Although RCRDC seems not to be directly conducting research activities in Ha Tinh and Quang Binh, it has provided sweetpotato varieties such as KLC266 for models in Ha Tinh.

The **Thai Nguyen University of Agriculture and Forestry** (TUAF), having published on cassava and potato farming practices, was involved in cassava trial varieties in Quang Binh (IBC project).

The **Plant Resources Center** (PRC) is in charge of the conservation and utilization of plant genetic resources for food and agriculture. PRC is responsible for a gene bank that holds 16,000 accessions, including 2,100 RTCs.

3.1.3. Civil society organizations

Civil society organizations are closely linked with the Vietnamese government, adopting a top-down approach with representatives at all administrative levels. There are local representatives of the **Vietnam Farmer Union** (VNFU) and the **Vietnam Women Union** (VWU) in each village. These organizations are responsible for conducting activities in relation to "propaganda," communication regarding new strategies, projects, and programs of the government. They closely collaborate with government agencies such as DARD and DONRE. For instance, the local branch of VNFU in Cam Lac commune (Ha Tinh) is experimenting a new model of sweetpotato cultivation. At the provincial level, Quang Binh Farmer Union is calling for investment in sweetpotato development project in Le Thuy District.

The **Vietnam Cassava Association** (VICAS) is a civil society organization established under the Ministry of Home Affairs in accordance with Decision 103/QĐ-BNV made on 4 January 2013. VICAS includes individuals and organizations working in cassava-related research, processing, and production; it aims to promote collaboration among cassava producers. However, we have not heard about any activities of VICAS in the considered provinces.

3.2. National and international NGOs

Only a few NGOs operate in the field of agricultural development in Quang Binh and Ha Tinh provinces. Most of them work in the field of natural resources and forestry.

The **Rural Development and Poverty Reduction** [Fund] (RDPR) operates mostly in Quang Ninh district, Quang Binh, supporting rural development, community development, and poverty reduction. It has especially supported the Van Kieu ethnic minority people, providing capacity building, training on agricultural practices, and support in land-use planning.

The **Centre for Indigenous Knowledge Research and Development** (CIRD) works with ethnic minorities and the marginalized poor in rural mountainous areas to help them access land and natural resources. In Quang Binh, CIRD intervenes in Tuyen Hoa district through a participatory forest management project. CIRD activities in Quang Binh were notably funded by Oxfam.

People and Nature Reconciliation (PAN Nature) is dedicated to protecting and conserving the diversity of life and improving human well-being in Vietnam. It currently conducts a research project on the impact of cassava expansion on deforestation in Vietnam (case studies in Tay Nguyen and Nghe An provinces).

Oxfam is active in the two provinces, mostly working on social accountability, humanitarian issues (emergency responses to flood), as well as community-based forest management through CIRD.

The **Netherlands Development Organization** (SNV) has been active for a long time in Quang Binh province. After running several projects on cassava value chains, SNV is henceforth focusing on sustainable rice intensification (SRI).

3.3. Value chain actors

Most of the RTC producers are smallholder farmers. They face many problems, including vulnerability to weather events. They have expressed interest in getting more support on a wide range of topics including (i) access to improved varieties, with higher yields, higher starch content, and shorter cycle; (ii) training on farming and soil management practices; (iii) postharvest and processing techniques; and (iv) market access and business practices. Farmers also face difficulties in applying crop management recommendations from extension services as they are largely input-based, and farmers do not always have the cash or access to credit to make these a reality.

Traders want to improve their financial capacity to buy bigger volumes. They also highlighted the need to help farmers gain access to better varieties and better postharvest and storage practices.

Small-scale sweetpotato processors mentioned their need for capital and business skills, including the creation of brands and ways to identify better markets.

Large-scale cassava processors face different kinds of problems, the most important of which are the low cassava root supply, the low starch content of roots, and the management of their effluents. They specifically mention the need for assistance in treating waste water and in operating a biogas system. They also insisted on the need to support farmers in accessing and adopting new improved varieties (other than KM94) and in adopting new management practices. Revising government guidelines on farming practices and providing better extension material with a proper extension strategy are also required.

3.4. CGIAR centers and CGIAR Research Programs (CRPs)

CIAT was involved in two different cassava projects in Quang Binh (4FGF and IBC), mostly on the agronomic side, implementing participatory trials in order to compare results of different crop management and fertilization practices and to assess the potential of new improved varieties.

ICRAF is active in Ha Tinh through at least two different climate change projects: (i) Smart-Tree Invest, looking at the potential of agroforestry to cope with climate change and (ii) My Loi Climate-Smart Village, to test a range of farming practices and climate services in order to adapt to climate change.

Apart from these projects, CGIAR centers are working toward better coordination and collaboration through increased integration across CRPs and a strengthened ability to work with a wide range of partners. The site-integration process has started in December 2015 during a Stakeholders' Consultation Workshop aiming at identifying common goals and opportunities for site integration in the agroclimatic zones of Vietnam. Several recommendations have been formulated for the North Central Coast area, including addressing the need for (i) research on economic and environmentally sustainable units of scale (small, medium, large); (ii) improved market linkages for smallholder farmers; (iii) forecast for rice, roots and tubers, and other crops; (iv) research on animal and fish feed production from cassava and maize by-products; (v) involvement of local research centers to do research on crops that are resilient to impacts of climate change (CGIAR 2015).

4. KEY CONSTRAINTS AND OPPORTUNITIES FOR RTCS TO ENHANCE FOOD RESILIENCE

4.1. Vulnerability and role of RTCs

In the past, according to farmers, storms affected agriculture more seriously and frequently than they do now. Since the government has improved infrastructure (e.g., dams and irrigation systems) in the early 90s, the impacts of storms and heavy rains have been mitigated, contributing to a stable rice supply and thereby sustaining the food security of the region. Nevertheless, heavy rains and storms still cause floods in lowland farming areas, affecting agricultural production, mostly between July and October. The Lekima storm in 2008, which destroyed all agricultural produce and assets, is still fresh in the memory of many farmers. In this respect, **sweetpotato is a particularly climate-resilient crop as it can be grown and harvested quickly (after such a disaster) with minimum investment on inputs and labor**. The same phenomenon has been observed with cassava after the Haiyan typhoon in 2013; hundreds of hectares of rubber have been destroyed and replaced by cassava (intercropped with young rubber trees), enabling farmers to get incomes before the new rubber trees become mature.

Farmers also report that cassava (and sweetpotato to a lesser extent) is particularly resistant to drought, more than any other crops they grow in the area. **In the climate change context faced by Ha Tinh and Quang Binh, characterized by an expectedly drier and hotter weather, cassava could be a key resilient crop to ensure continuation of agricultural activities**. Farmers also start to abandon growing of vegetables during summer, even the second rice crop, because of water shortage. They replace these with sweetpotato. The DARD strategy to cope with climate change is different though. In Ha Tinh, for instance, local authorities encourage farmers to shift from rice production to grass and forages in order to meet the growing demand for animal feed. In this respect, cassava for animal feed has potential since it grows in drier and less fertile uplands, which are not much affected by floods.

4.2. Perceptions of food security and food insecurity

Concepts of food security and food insecurity are closely associated with quantity of rice. Household food insecurity is equated to seasonal rice shortages in which the family cannot achieve the quantity of food they need. As mentioned before, the problem of rice shortage was almost solved in the mid-90s. However, in each commune, there are still a few food-insecure households that do not produce sufficient rice and have limited sources of income. In this case, they borrow rice from neighbors or relatives; moreover, they eat far

less meat compared with other standard households. Their food-insecure situation is often attributed to a shortage of labor and/or land. In both situations, farmers' interests and motivations to sustain food security take them away from rural areas; migrating to towns, cities, and foreign countries. This makes sense for families with labor and land shortages, given the low market value of agricultural produce; people need larger farming areas and less labor-intensive work in order to generate sufficient income from agriculture. These land and labor issues will have to be taken into account in order to offer innovative approaches that would meet the needs of food-insecure households.

4.3. Changes in diets and perceptions of 'good' food

Over the past two decades, diets of rural farmers have greatly improved. Currently, animal-sourced food is consumed every day in many households, contributing to a lower rate of micronutrient deficiencies in the region. Among the varieties of animal-sourced food, fish is the most accessible to the poor, especially in the coastal areas, while beef is still considered a luxury meat compared with pork, chicken, duck and eggs, which are already available and affordable for many households.

Although Vietnam is well-known for its well-balanced and healthy diet in general, the perception of 'good' food does not necessarily come from the nutritional perspective. In the past, people's ideal meals required a lot of **rice**, since rice is a precious crop. Pregnant and breastfeeding women were encouraged to eat more rice, indicating that rice was considered a 'good' food. However, since rice production became sufficient, the desired diet has also changed. Beef is listed as a food that both men and women want to consume more if their income increases; the women's desire to consume more beef seems to come from concerns over food safety in pork production. **Fruit** is another kind of food that farmers, especially women, want to eat more; many farmers already grow fruits, such as bananas and papayas, while other kinds of fruit are not yet affordable. Both men and women also want to eat more **vegetables**, indicating the cultural importance of vegetables in their diet. In this respect, increased income from agricultural interventions is likely to contribute to diversifying diets and improving nutrition, as well as a shift toward safer food. On the other hand, some farmers, especially men, are more interested in increasing expenditures on wine and food for ceremonies such as weddings and funerals. Some farmers also said that their food expenditure will not increase even with increased income because they are satisfied with their current diets. The additional income is likely to be invested in agriculture or migration to maintain long-term food security and well-being. Thus, in the area considered, agricultural interventions for improved food security and nutrition do not necessarily aim directly at immediate improvement in diet quality and quantity but to long-term investment in improved overall well-being.

4.4. Changes in the roles of men and women

For the Kinh ethnic majority in central Vietnam, some aspects of agricultural activities and domestic work are shared between men and women. Although men are responsible for earning income and doing heavy tasks in farming such as preparing land and harvesting cassava, they also help with domestic work. Women are also expected to earn income in addition to their conventional roles of nurturing and cooking, and men accept that their wives and daughters may work as traders or even go abroad. The women who earn income are highly respected, meaning that agricultural interventions can involve women in income-generating activities without the risk of gender tension within households. Nevertheless, there seem to be implicit gendered divisions of labor in many agricultural activities. For example, cassava collectors and traders tend to be men, and male farmers are usually the ones interacting with traders. They are more interested than women in selling their produce at higher prices. Women are in charge of selling sweetpotato and cassava at the local markets, and they are more interested in adding value to their produce through processing. **In some communes, women perceive cassava production as hard work and they expect innovative approaches in reducing labor and arduousness, while men consider it easy to do and have more interest in higher yield and higher market value**, and therefore increased income. Young men and women from low-income households with limited education tend to be absent from agriculture, having left to find other work, and the mission was not able to meet them during the FGDs. Further research is required to identify the interests of these young men and women in agricultural innovation.

4.5. Migration

Labor migration is a major strategy for young men and women to generate income since income from agriculture is limited. In Ha Tinh province, well-established networks are used to send family members to foreign countries such as Angola, South Korea, Taiwan, Malaysia, and Japan. In Xuan Lien commune, for example, around 1,650 people (out of 7,800) are currently working overseas, sending significant remittances, more than VND 320 billion per year[12], representing about 70% of the village income. The mission has not been able to identify specific mechanisms to invest these remittances in agriculture. Although the case of Xuan Lien may be extreme, both internal and international migration appears to be popular among many young people in this region as an alternative to low and unstable income obtained from agriculture.

[12] USD 15 million

While labor migration plays a significant role in diversifying sources of income in the climate-vulnerable context, the absence of a younger generation in agriculture is worrisome. In this context, interventions for supporting agriculture and local added value production need to make the work more efficient, more profitable, and hence more attractive to younger people.

5. *CONCLUSION: Key focus areas and priorities for action research and policy influence*

Several potential priority action research and development areas have been identified:

- The need for better varieties has been raised by all the stakeholders we met. **One particular need is a cassava variety with shorter growth cycle**. It would reduce vulnerability to summer flash floods, enable the spread of the harvest season for a longer period, and avoid too much price fluctuation. **Cassava varieties with higher yield and higher starch content** are also required to raise economic productivity of the land (for most farmers having small plots) and reduce processing cost of factories. Participatory trials and demonstration plots would be useful to take advantage of findings from previous field tests conducted in Quang Binh and to ensure proper dissemination of varieties with best potential. As to sweetpotato, **farmers are willing to try new varieties, especially those with huge market potential**. Nutritional aspects have not been mentioned by farmers, but it likely underlies current market dynamics in the urban areas.

- **Better access to planting material** seems to be a key leverage point, especially for sweetpotato. Farmers struggle with variety degeneration and, in some cases, had to abandon some varieties even when variety characteristics meet farmers' needs. Research on sweetpotato multiplication techniques or sustainable supply of planting material would be of great interest.

- **Cassava crop management** is another important issue. Smallholder farmers are seeking ways to improve productivity, relying less on input application. Intercropping systems (with legumes, for instance) could be investigated. The same is true for soil management practices, in order to address erosion and soil degradation happening in the provinces studied (especially as cassava is often grown on poor soil). Extensive CIAT experience on these issues in Southeast Asia can contribute to meeting these needs by adapting previous research results and focusing on ways to make these adopted by smallholder farmers. Training and extension strategies have to be assessed and redesigned toward producers' gendered needs and capacities.

- **Postharvest and on-farm processing are problematic.** Smallholders sometimes have difficulties in drying sliced cassava and sweetpotato properly, resulting in postharvest losses. Seeking innovative processing technologies for basic processing might be a research topic of interest.

- **Cassava-starch value chains** could be enhanced through several ways, in terms of both sustainability and inclusiveness. Farmers complain about low and unstable prices of cassava fresh roots. They also have little knowledge of the final use of the produce and of the different market opportunities available. Linkages are weak among value chain actors, leading to side-selling effects, increasing the low level of trust among actors. Lack of transparency about the price structure has also been mentioned by farmers. Farmers get little or no advantage from increasing the starch content of their cassava roots inasmuch as there is no incentive for quality. **Farmers are not actively involved in the cassava value chain governance and have no negotiation capacities regarding prices**; they are basically price takers and have no influence on value chain development. Even if value chain stakeholders know each other, there is a lack of coordination between them, especially during the harvest season, leading to under- and oversupply of factories and contributing to price instability of fresh roots. Participatory research on how a value chain operates and on what relationships are existing between direct and indirect actors of the value chain is needed. Assessing business models and comparing the approaches of the different factories would enable us to precisely identify bottlenecks and leverage points in order to support the development of these value chains. The same analysis should be conducted for the other cassava value chains operating in the area, notably the ones involving wet starch processors. There is little knowledge on these value chains, although they have potential for poverty reduction and increased food security of the poor. Deeper investigations should be conducted regarding the previous experience of these factories in establishing links with smallholder farmers.

- **An RTC market assessment should be conducted at the provincial level** in order to identify current trends of consumption (including consumer perception of RTC products), both for raw and processed food, and to advise farmers on their choice of varieties and marketing strategies.

- **The potential of RTCs as animal feed should be investigated further as well**. Demand for animal feed is increasing and it depends on imported maize (with price volatility risks) as well as on local maize, whose production is highly vulnerable to climate change effects (e.g., dry and hot weather events). Although cassava and sweetpotato roots are already used as animal feed by smallholders, larger scale farms seem to be not interested in using and buying RTCs to complete their feed supply. Given the resistance of RTCs to hot and dry weather, this could be a way to secure and stabilize feed supply over time. Further research on the use of cassava leaves, as well as cassava residues from starch-processing factories, is needed.

- **Sweetpotato shoots are in high demand as a daily vegetable fare**. Although all the interviewed farmers reported producing sweetpotato shoots for their own consumption, these are available in local markets and are consumed by urban people. Further research regarding these value chains would be needed to highlight bottlenecks and potential leverage points to make it more profitable for producers and more attractive (in terms of nutritive value) to consumers.

- Research on understanding social contexts will be central to identifying gendered needs and interests and addressing social power relations played out in the process of agricultural innovation. Social research will help provide agricultural interventions that facilitate adaptation of the poor and the marginalized and address the issues of social inequality based on gender, age, and ethnicity.

All these issues have been discussed during the stakeholders' validation workshops held in Quang Binh and Ha Tinh on 21 and 22 of January 2016. The main outputs of the workshops are in Annex 6.

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Annexes

Annex 1: Guidelines for key informant interviews

Food Resilience through Root and Tuber Crops
in Upland and Coastal Communities of the Asia Pacific
FoodSTART+ scoping study
Guidelines for key informant interviews in Vietnam

Interviews will be conducted with the following main objectives:

- Verifying and completing secondary data (and filling gaps)
- Understanding trends, opportunities, and challenges for RTC development
- Establishing contact and working relationships for later joint action

The following actors will be targeted:

- SRDP teams
- Provincial authorities and government agencies/institutions, including
- RTC value chain actors, including private sector at all scales and all stages in value addition:
    - Smallholder and larger-scale farmers as well as farmer groups and cooperatives
    - Rural traders, local processors, exporters, etc.
- NGOs and donors, including SNV, ADDA, GIZ, and REDD Vietnam
- Other CGIAR centers and CRPs, including ICRAF and CCAFS
- Other projects that used to work on RTCs in the area
- Other key informants might be selected after consultation with IFAD investment project staff

Tips for conducting the interviews:

- Be prepared to follow up on interviewees' replies. You may not strictly follow the checklists below
- Ask questions about income/money at the end of the interview, after building trust in the relationship
- Be flexible and ready to get names of new actors that we might want to meet/interview

Below are different checklist questions for various groups:

- Farmers
- Collectors/traders
- Processors
- Local authorities
- Extension staff
- NGOs/project

Farmer

Name
Location
Age
Sex

1. Main activities for livelihood/revenue
2. Importance (%) of farming activities in household income
3. Size of the farm
4. Main crops/livestock
5. Importance of RTCs in terms of area of the farm; trends
6. Importance of RTCs in terms of income; trends
7. Importance of RTCs in terms of food security (food access/ food availability / food use); trends
8. Which RTCs do you grow? Areas (ha/sao)?
9. Production volumes and/or yields
10. Which varieties? Where do you source your inputs (in particular, seed)?
11. Since when have you grown RTCs? Why did you choose them?
12. What about seasonality? Any variations in the last few years?
13. Do you intend to continue growing RTCs? Increase/decrease? Why?
14. Main constraints/challenges faced in terms of agricultural production, especially for RTCs
15. Which use of RTC (consumption on farm, livestock feed, markets; % for each channel)
16. Which market opportunities for RTCs; Good/bad? Trend?
17. Current linkages with buyers/traders/processors? Formal/informal?
18. Is the relationship satisfying? Why?
19. Are RTCs more profitable than other crops? Why?
20. Main constraints/challenges faced in terms of accessing markets (focus on RTCs)
21. Do you process RTCs? Why?
22. Do you know any processors?
23. Opinion on/experience with RTC ability to cope with climate change (heat, flood, cyclones)
24. Any suggestions about any contact with a good knowledge of RTCs?

Collector/Trader

Name
Location
Age
Sex

1. Main activities for livelihood/revenue
2. Importance (%) of trading activities in household income
3. Main products traded
4. Importance of RTCs in the trading business; in terms of volume/revenue
5. Which RTCs do you trade?
6. In which communes/districts/provinces do you trade?
7. How many farmers do you work with?
8. What volumes? Any seasonality? Any trends in terms of volume/prices/quality?
9. Is the relationship with farmers satisfying? Why?
10. What about competition with other collectors/traders?
11. Who are your clients? Small/medium/large-scale industries? Wholesalers? Retailers?
12. Is the relationship with clients satisfying? Why?
13. Do you process RTCs? Why?
14. Do you know any processors (in particular, small and medium scale)?
15. Opinion on/experience with RTC ability to cope with climate change (heat, flood, cyclones)
16. What are the main problems/constraints that you face?
17. Any need for external support, especially in terms of research?
18. Any suggestions of any contact with a good knowledge of RTCs?

Processor

Name
Location

1. Small scale or large scale
2. Daily and annual volumes

3. Which RTCs do you process?
4. What are the final products? Proportion of each product?
5. Describe the process
6. Main technical constraints
7. In which communes/districts/provinces do you operate?
8. Who are your suppliers?
9. With how many farmers/collectors do you work?
10. What volumes? Any seasonality? Any trends in terms of volume/prices/quality?
11. Do you have a formal or informal relationship with suppliers? Explain.
12. Is the relationship with suppliers satisfying? Why?
13. What about competition with other processors?
14. Who are your clients? Domestic/export?
15. Is the relationship with clients satisfying? Why?
16. What are the main problems/constraints that you face?
17. Any need for external support, especially in terms of research?
18. Any suggestions of a contact with a good knowledge of RTCs?

Local authorities

Name

Location

Organization

1. Which trends in terms of agricultural development (past and future)
2. Which trends in terms of RTCs development
3. Any data regarding RTCs at the village/commune/district level
4. Any strategy for RTC development at the commune/district level
5. Any strategy for agriculture in order to cope with climate change at the village/commune/district level
6. What are the main problems/constraints that you face?
7. Any need for external support, especially in terms of research?
8. Any suggestions of a contact with a good knowledge of RTCs?

Extension staff

Name
Location
Organization
Area of intervention

1. Which trends in terms of agricultural development (past and future)
2. Which trends in terms of RTC development
3. Any data regarding RTCs at the village/commune/district level
4. Any strategy for RTC development at the commune/district level
5. Any strategy for agriculture in order to cope with climate change at the village/commune/district level?
6. What are the main problems/constraints that farmers face in terms of production and marketing?
7. What are the main constraints that you face in your extension activities?
8. Any need for external support, especially in terms of research?
9. Any suggestions of a contact with a good knowledge of RTCs?

NGO/project staff

Name
Location
Organization

1. Name and topic of the project(s) implemented by your organization
2. Any component related to RTCs?
3. Any intention to work on RTCs in the future?
4. Which trends in terms of agricultural development (past and future)?
5. Which trends in terms of RTCs development?
6. Any data regarding RTCs in the area?
7. Any strategy for agriculture in order to cope with climate change at the village/commune/district level?
8. What are the main problems/constraints you face?
9. Any need for external support, especially in terms of research?
10. Any suggestions of a contact with a good knowledge of RTCs?

Annex 2: Guidelines for focus group discussions

Food Resilience through Root and Tuber Crops
in Upland and Coastal Communities of the Asia Pacific
FoodSTART+ scoping study
Guidelines for focus group discussion in Vietnam

1. Background

As part of the scoping study component (Activity 1.1.) of FoodSTART+, focus group discussions (FGD) will be conducted in selected sites of the IFAD investment project. FGD is one of the methodologies for field appraisal used in the scoping study.

The objective of the FGD is to collect information on

- RTC production, marketing, and rural processing in the context of production, livelihood and food system, RTC contribution to agro-ecosystem
- Issues related to vulnerability, resilience capacity, role of RTCs in post-disaster situations and extreme weather events
- Perceptions of food security and insecurity, changes in household diets
- Changes in the roles of men and women, perceptions of "good" food/diet, consumption and nutrition, livelihood activities, migration
- Other issues around gender that need to be explored
- Adaptive or organizational capacity in terms of scoping

Outputs will be the minutes of the FGD, as well as records of FGD results.

2. Preparation

Sites. The FGD sites will be identified in consultation with IFAD investment project staff. FGDs are conducted in the villages. IFAD investment projects are working in a large number of villages, and it will not be possible to cover all of these. Therefore, villages, that represent IFAD investment project sites and where RTC livelihood is important are selected. Number and location of sites are subject to time and resources available. In Vietnam, we will conduct 12 FGDs in six different villages.

Participants. The participants must be representative of the agriculture-forestry households that have planted root crops (e.g., sweetpotato, cassava, taro/aroids, yam, etc.). Each FGD group must have about four to five participants. In each village, two FGDs will be conducted; one for a male group and one for a female group. Selection of participants and sending out of invitations are facilitated by the IFAD investment project staff.

Logistics/Materials. The scoping study team should prepare the following:

- Ao paper, markers and pens of different colors, multicolored meta cards
- Food/snacks (relatively heavy + root crop-based food)
- Attendance sheet for participants (name, male/female, contact address, etc.)

3. Conduct and facilitation

Timing. The FGDs will last for about 2-3 hours (3 hours maximum). Please note that participants might lose attention/ interest if discussions are too long.

Tasks and roles. Composition of CIAT team will be as follows:

- One main facilitator, animating the discussions
- One interpreter, also helping in general logistics and recording
- One scientist, taking notes and pictures and keeping time

The IFAD investment project staff may also help if they join the FGD.

4. FGD proper/schedule

Introduction

- Warm-up approach. This could be an energizer to "break the ice."
- Introduction of facilitators and participants. Encourage the participants to introduce themselves.
- Introduction of the FoodSTART+ project; state the purpose of the scoping study and FGD. Part of the scoping study to guide the planning and implementation of IFAD investment project and FoodSTART+ collaboration.

Guide questions/ concepts/ issues. It will be difficult to address all the following topics in each FGD. The FGD team will choose to focus on some of these topics according to the villages and the audience. Ideally, every topic should be addressed in each village, spread over the two FGDs (male and female groups).

A. Livelihood system mapping. 15-20 minutes maximum

The facilitator provides one card and markers to each participant. Each participant is asked to draw his/her livelihood system and food sources; both from farm and off-farm, including migration (temporary, permanent). The facilitator collects and posts the answers in a large sheet of paper and reads them. Additional comments might be asked by the facilitator.

The idea is to capture the big picture of livelihood at the village level. The facilitator can ask how many percentage of villagers are engaged in each kind of livelihood (e.g., 100% of households grow rice for food and cassava for cash income).

B. RTC production, marketing and processing (household, community levels) and contribution to agro-ecosystem. 60 minutes.

The facilitator will ask few key questions and will launch an open discussion among participants. The facilitator has to pay attention to keep the debate in the framework of our interest and at the same time be flexible/discreet enough to enable participants to be at ease and to express themselves freely. Below is a checklist of questions that will have to be addressed.

Production:

a. What do you grow (if not answered before)? What did you use to grow in the past years? How is it changing and why? Did you or do you grow RTCs and why? How many years so far? Positive or negative evolution?
b. Yields: trends of yields? Why? Do you think you could increase yields?
c. Crop calendar: When do you plant? When do you harvest? When does the rain come? When is the dry season?
d. Profit: Which crop is more valuable (not only with respect to financial aspects) for you? Why?

e. Gender roles: Who does what in terms of production? Crop-differentiated? Task-differentiated? Are you more interested in cash crop or in subsistence crop? General interest regarding choice of crop (is there any conflicts between men and women for the choice of crops to grow)?
f. Main constraints in terms of production
g. What do you need to improve your production?

Post-harvest and marketing: What do you do with this production? Do you eat or do you sell?

h. If you keep, how do you store?
i. If you sell, where/who do you sell it to? Can you negotiate the price? Regular buyer? Do you know the final use of the product when you sell it?
j. Do you have any contract with buyers? % among villagers?
k. Do you sell by yourself in local markets? % among villagers? Margins?
l. Main constraints in terms of postharvest steps (storage, accessing markets, etc.)?
m. Do you make money with RTC? Do you think you could make more money with RTC?

Processing:

n. Do you process any RTC crop? What do you process?
o. Do you sell to processors? Why?
p. If you do not process, why?
q. How many processing places are there in the village/commune?
r. Which kind of RTC processed products do you know?
s. How many different channels are there for processing? % for each?
t. Are you interested in doing processing by yourself?

C. Perceptions of food security and insecurity. 30-40 minutes maximum

Perceptions of food security and of "good" food/diet, as well as changes in household food habits (consumption and nutrition) will be discussed. Special attention will be given to the role of RTCs in diets. The facilitator can use a seasonal farming calendar and superimpose with food-secure and hunger months. Below is a checklist of questions that will have to be addressed:

Patterns and changes in household food consumption and diets (own food, bought food, gifts and donations):

u. What is a typical diet in the village? How did it change in the past 10 years?

Changes in roles of men and women, perceptions of "good" food/diet, consumption and nutrition, livelihood activities

v. What is a good[13] diet for you? Why? Is it different for women/men/children?

Vulnerable and risk months related to livelihoods and food; role of RTCs in post-disaster situations and extreme weather events

w. Are there any differences in terms of diet inside the village? What kind of households have better diets?

[13] Make sure not to translate 'good' as 'nutritious'. We want to understand men's and women's perceptions about an ideal meal. It could be about taste, cost, nutrient content, quality, quantity, etc. Keep the question open.

x. Do you miss food? Do you think some people miss food in the village? Does it affect your/their health?
y. Do some families experience skipping a meal or reducing the quantity or quality of the meal?

D. Vulnerability and resilience capacity. 60 minutes maximum

Vulnerability of smallholder, as well as role of RTCs in post-disaster situations and extreme weather events, will be discussed. If possible, adaptive and organizational capacities to cope with extreme events will be assessed. Below is a checklist of questions that will have to be addressed.

z. Weather: Did you notice any change in the past 10/20 years? Positive or negative? Does it affect your strategy to choose your crops?
aa. Extreme weather events: Have extreme events occurred in this village? What are the consequences? What did you do?
bb. Do you think some crops are better for the local current climate? Extreme weather events? Which ones?
cc. Do you think some crops are more sensitive/vulnerable to price variations? Which ones?
dd. Local practices for climate change impact mitigation and/or adaptation (at the household and community levels)
ee. What is your strategy to cope with negative events (price decreasing, typhoon, flood)?
ff. Do you receive any advice/support from organizations to help you define your strategy?
gg. Do you consider your village/community resilient or vulnerable? Why? Advantages and weaknesses of your village? Of your farm? How would you position your village in comparison with other surrounding villages? Does RTC have a role in this?
hh. Do you think RTC is helping achieve resiliency? Why?

E. Other issues around gender and local organizations that need to be explored (capacity, strength, activities) Max 20 minutes (only if enough time)

ii. Changes in marriage practices (arranged marriage, living with in-laws, rules about the relationships between a daughter-in-law and mother-/father-in-law [e.g., they never sit in the same table, daughter-in-law should wake up early])
jj. Gender roles in housework and changes over a decade. (This question is asked to understand how conservative the village is and how women can negotiate with men to share domestic work –to see power relations).
kk. Men's social activities (e.g., drinking in funerals, gambling, smoking) and women's social activities (e.g., do women have opportunities for chatting with the same age and gender groups?) (this question is very useful for gender analysis – I will explain later about how we use this in the report if you want to know)

Closing. Thank the participants for their time and contribution to the FGD.

Annex 3: List of SRDP communes in Quang Binh

No.	District/ commune	Total HH	No. of villages	Poor HH	Poor HH ratio (%)	Near poor HH	Near poor HH ratio (%)	No. of minority HH	Minority HH ratio (%)	Remarks
I	**LE THUY**	**3,573**	**37**	**1,718**	**48.08**	**686**	**19.20**	**1,277**	**35.73**	
1	Lam Thuy	315	6	263	83.49	17	5.40	296	94.00	Year 1
2	Thai Thuy	1,116	7	312	27.96	369	33.06			Year 1
3	Ngan Thuy	457	6	337	73.74	52	11.38	306	67.00	Year 2
4	Kim Thuy	924	11	600	64.94	96	10.39	675	73.00	Year 2
5	Van Thuy	761	7	206	27.07	152	19.97			Year 2
II	**QUANG NINH**	**5,168**	**44**	**1,574**	**30.46**	**1,002**	**19.39**	**779**	**15.06**	
6	Truong Xuan	553	10	258	46.65	68	12.30	216	39.00	Year 1
7	Hien Ninh	2,019	8	434	21.50	431	21.35		0.00	Year 1
8	Truong Son	954	19	496	51.99	162	16.98	563	59.00	Year 2
9	Gia Ninh	1,642	7	386	23.51	341	20.77		0.00	Year 2
III	**BO TRACH**	**9,292**	**77**	**4,618**	**49.70**	**1,723**	**18.54**	**477**	**5.13**	
10	Phuc Trach	2,478	12	1,581	63.80	533	21.51		0.00	Year 1
11	Lam Trach	806	7	632	78.41	27	3.35		0.00	Year 1
12	Xuan Trach	1,316	10	812	61.70	247	18.77		0.00	Year 1
13	Thuong Trach	477	18	473	99.16	3	0.63	477	100.00	Year 2
14	Lien Trach	909	5	366	40.26	255	28.05		0.00	Year 2
15	My Trach	592	7	145	24.49	374	63.18		0.00	Year 2
16	Hung Trach	2,714	18	609	22.44	284	10.46		0.00	Year 2
IV	**QUANG TRACH**	**12,014**	**58**	**5,695**	**47.40**	**3,346**	**27.85**	**0**	**0.00**	
17	Quang Hai	649	6	297	45.76	267	41.14		0.00	Year 1
18	Quang Tien	1,317	7	377	28.63	533	40.47		0.00	Year 1
19	Quang Phuong	2,074	4	543	26.18	675	32.55		0.00	Year 1
20	Quang Thach	904	9	590	65.27	188	20.80		0.00	Year 2
21	Phu Hoa	944	6	616	65.25	38	4.03		0.00	Year 2
22	Quang Hop	1,434	6	909	63.39	406	28.31		0.00	Year 2

23	Canh Hoa	1,096	7	646	58.94	108	9.85		0.00	Year 2
24	Quang Chau	2,197	9	1,169	53.21	703	32.00		0.00	Year 2
25	Quang Van	1,399	4	548	39.17	428	30.59		0.00	Year 2
V	**TUYEN HOA**	**5,669**	**50**	**2,804**	**49.46**	**1,332**	**23.50**	**139**	**2.46**	
26	Thanh Hoa	1,593	11	797	50.03	364	22.85	40	2.53	Year 1
27	Cao Quang	667	9	290	43.48	134	20.09			Year 1
28	Lam Hoa	245	6	149	60.82	22	8.98	98	40.04	Year 2
29	Le Hoa	706	5	385	54.53	118	16.71			Year 2
30	Thanh Thach	506	4	266	52.57	94	18.58			Year 2
31	Kim Hoa	1,297	8	621	47.88	438	33.77			Year 2
32	Thuan Hoa	655	7	296	45.19	162	24.73	1	0.15	Year 2
VI	**MINH HOA**	**6,173**	**84**	**4,273**	**69.22**	**1,133**	**18.35**	**1,672**	**27.09**	
33	Trong Hoa	713	18	632	88.64	18	2.52	675	94.67	Year 1
34	Minh Hoa	822	9	482	58.64	312	37.96		0.00	Year 1
35	Hoa Hop	854	9	473	55.39	245	28.69	138	16.16	Year 1
36	Dan Hoa	746	13	667	89.41	9	1.21	666	89.28	Year 2
37	Tan Hoa	645	7	467	72.40	178	27.60		0.00	Year 2
38	Hong Hoa	739	10	535	72.40	52	7.04	11	1.49	Year 2
39	Thuong Hoa	722	10	495	68.56	101	13.99	181	25.07	Year 2
40	Yen Hoa	932	8	522	56.01	218	23.39	1	0.11	Year 2
	Total of 6 districts	**41,889**	**350**	**20,682**	**49.37**	**9,222**	**22.02**	**4,344**	**10.37**	

YEARLY PROJECT-PARTICIPATED COMMUNES

No.	2014		No.	2015	
	Commune	**District**		**Commune**	**District**
1	Lam Thuy	Le Thuy	1	Ngan Thuy	Le Thuy
2	Thai Thuy	Le Thuy	2	Kim Thuy	Le Thuy
3	Truong Xuan	Quang Ninh	3	Van Thuy	Le Thuy
4	Hien Ninh	Quang Ninh	4	Truong Son	Quang Ninh
5	Lam Trach	Bo Trach	5	Gia Ninh	Quang Ninh
6	Phuc Trach	Bo Trach	6	Thuong Trach	Bo Trach
7	Xuan Trach	Bo Trach	7	Lien Trach	Bo Trach
8	Quang Hai	Quang Trach	8	My Trach	Bo Trach
9	Quang Tien	Quang Trach	9	Hung Trach	Bo Trach
10	Quang Phuong	Quang Trach	10	Quang Thach	Quang Trach
11	Thanh Hoa	Tuyen Hoa	11	Phu Hoa	Quang Trach
12	Cao Quang	Tuyen Hoa	12	Quang Hợp	Quang Trach
13	Trong Hoa	Minh Hoa	13	Canh Hoa	Quang Trach
14	Minh Hoa	Minh Hoa	14	Quang Chau	Quang Trach
15	Hoa Hop	Minh Hoa	15	Quang Van	Quang Trach
			16	Lam Hoa	Tuyen Hoa
			17	Le Hoa	Tuyen Hoa
			18	Thanh Thach	Tuyen Hoa
			19	Kim Hoa	Tuyen Hoa
			20	Thuan Hoa	Tuyen Hoa
			21	Dan Hoa	Minh Hoa
			22	Tan Hoa	Minh Hoa
			23	Hong Hoa	Minh Hoa
			24	Thuong Hoa	Minh Hoa
			25	Yen Hoa	Minh Hoa

Annex 4: SRDP communes in Ha Tinh.

PROVINCIAL PEOPLE'S COMMITTEE OF HA TINH
PROJECT PREPARATION BOARD IN PHASE III

PROPOSALS ON DISTRICTS AND COMMUNES IN PROJECT AREAS
HA TINH PROJECT OF SUSTAINABLE RURAL DEVELOPMENT FOR THE POOR (SRDP)

Total population in 2011: 1,229,197 people; total area in 2011: 600,023 ha
There are 10 districts, 1 town, and 1 city, of which 227 communes are in rural areas, 13 townlets, 15 wards and 7 communes in urban areas

No.	District/commune	CPC staff		Total areas (ha)	Total agricultural land (ha)	Of which			Others (ha)	Statistics as of end of 2011						Number of local enterprises	Number of local cooperatives	Number of local collaborative groups
												Poor & near poor HHs						
		Total staff	University & college education			Agriculture production (ha)	Aquaculture (ha)	Forestry (ha)		Total HHs	Total population	Poor HHs	Percentage	Near poor HHs	Percentage			
I	**Vu Quang**	**148**	**35**	**17,456**	**12,828**	**1,949**	**69**	**10,809**	**4,629**	**5,025**	**17,071**	**1,395**	**27.76**	**1,401**	**27.88**	**10**	**4**	**2**
1	An Phu	21	3	936	593.3	184.5	-	408.8	342.3	495	1,631	150	30.30	120	24.24	1	1	2
2	Duc Giang	21	5	1,230	796.4	250.5	-	545.9	433.7	832	2,573	214	25.72	273	32.81		2	
3	Duc Bong	21	6	1,372	526.5	34.7	0.2	491.6	845.4	827	2,695	227	27.45	291	35.19	8		
4	Duc Huong	20	6	1,839	998.1	500.0	15.7	482.4	840.5	912	3,256	254	27.85	216	23.68	1		

5	Duc Lien	21	5	2,668	2,020	599.8	10.3	1,410.3	647.3	612	2,075	155	25.33	109	17.81			
6	Huong Minh	22	6	4,850	4,498.1	196.5	43.1	4,258.6	351.9	665	2,385	209	31.43	153	23.01		1	
7	Huong Tho	22	4	4,562	3,394.8	183.5	-	3,211.3	1,168	682	2,456	186	27.27	239	35.04			
II	**Huong Khe**	**154**	**45**	**31,793**	**25,953**	**4,142**	**0.5**	**21,810**	**5,840**	**8,275**	**28,113**	**1,912**	**23.11**	**1,276**	**15.42**	**12**	**8**	**0**
1	Huong do	22	4	2,123	1,522.5	602.8		919.7	600.2	1,318	3,904	311	23.60	138	10.47		1	
2	Huong Lam	23	8	17,157	15,926	270		15,656	1,231	1,579	5,787	461	29.20	167	10.58	2	1	
3	Phuc Dong	22	9	2,151	1,096	714.72	0.50	380.90	1,055	1,711	4,361	367	21.45	306	17.88	3	1	
4	Huong Xuan	22	8	2,843	2,396	1,066		1,330	447.0	1,282	3,630	330	25.74	259	20.20	1	1	
5	Gia Pho	22	6	1,175	782.17	438.84		343.33	392.92	1,181	5,594	195	16.51	223	18.9	5	2	
6	Phuong Dien	21	5	1,416	971	339		632	445.2	575	2,157	155	26.96	51	8.87	1	1	
7	Phuong My	22	5	4,929	3,259.4	711.4		2,548	1,669	629	2,680	93	14.79	132	20.99		1	
III	**Huong Son**	**147**	**55**	**9,137**	**6,513**	**1,563**	**42**	**4,908**	**2,625**	**6,275**	**20,676**	**1,714**	**27.3%**	**1,654**	**26.36 %**	**9**	**18**	

1	Son Ha	21	6	349	217.5	214.8	2.7		131.0	721	2131	141	19.56	206	28.57	1	4	
2	Son Thinh	21	8	590	296.5	155.9		140.6	293.1	885	2536	286	32.32	331	37.40		2	
3	Son Hoa	20	10	398	220.0	198.0	18.7	3.4	178.1	713	2156	240	33.66	233	32.68		2	
4	Son Phuc	21	4	645	243.0	124.0	15.0	104.0	401.6	692	2231	226	32.66	249	35.98	1	1	
5	Sơn Lam	22	8	3,819	3,384.72	143.74		3,241	434.33	650	2634	208	32.00	182	28.00	2	3	
6	Sơn Quang	20	8	1,400	919.06	293.96		625.10	480.50	1407	5290	221	15.71	136	9.67	3	3	
7	Son Truong	22	11	1,938	1,231.8	432.5	5.3	794.0	706.2	1,207	3,698	392	32.48	317	26.26	2	3	
IV	**Duc Tho**	**84**	**16**	**3,430**	**2,678**	**1,587**	**30**	**1,061**	**752**	**3,257**	**10,274**	**575**	**17.65**	**783**	**15.02**	**7**	**7**	**0**
1	Duc Chau	21	3	452	234.01	234.01	0.00	0.00	218.48	605	1,979	120	22.86	148	24.46		1	
2	Duc Lac	21	5	770	516.3	497.6	18.7	-	253.6	1,132	3,224	139	13.21	123	10.87	2	3	
3	Duc Thanh	21	3	518	391.1	389.4	1.7	-	126.9	1,140	3,754	146	13.77	436	38.25	5	2	
4	Tan Huong	21	5	1,689	1,536.5	466.5	9.3	1,061	152.7	380	1,317	170	56.67	76	20.00		1	
V	**Can Loc**	**91**	**26**	**4,021**	**3,558**	**2,892**	**75**	**591**	**462.7**	**4,964**	**16,761**	**740**	**14.9 %**	**764**	**15.39 %**	**10**	**9**	**0**
1	Phu Loc	22	6	2,216	2,086.5	1,455	42.0	589.5	129.3	1,525	5,516	280	18.4%	238	15.6%	1	1	

2	Song Loc	19	9	514	456.9	455.4	1.5	-	57.0	1,143	3,960	150	13.1%	135	11.8%	5	1	
3	Khanh Loc	32	4	668	438.61	#####	-	1.71	229.00	1,185	3,974	130	10.97	208	17.55	3	3	
4	Kim Loc	18	7	624	576.1	544.9	31.2	-	47.4	1,111	3,311	180	16.2%	183	16.5%	1	4	
VI	**Thach Ha**	**119**	**34**	**5,710**	**2,888**	**2,244**	**238**	**406**	**2,822**	**7,350**	**27,004**	**1,174**	**15.97 %**	**1,147**	**15.61 %**	**29**	**13**	**11**
1	Thach Long	21	5	572	309.7	292.2	12.0	5.5	262.3	1,394	5,320	196	14.06 %	191	13.70 %	15	2	1
2	Thach Thanh	19	4	634	400.5	395.6	4.9		233.8	989	3,320	150	15.17 %	229	23.15 %	5	2	
3	Thach Vinh	21	8	1,213	626.9	606.9	12.0	8.0	585.9	1,647	5,993	261	15.85 %	250	15.18 %	3	2	2
4	Thach Ban	20	7	1,350	454.73	117.97	43.71	293.05	895.41	1,014	3,208	228	22.49	156	15.38	2	3	4
5	Tuong Son	18	3	825	435.2	371.6	63.2	0.3	389.8	1,032	4,256	148	14.34 %	146	14.15 %	4	2	4
6	Thanh Van	20	7	1,116	661.6	460.0	102.0	99.5	454.9	1,274	4,907	191	14.99 %	175	13.74 %	0	2	
VII	**Cam Xuyen**	**129**	**46**	**8,193**	**2,579**	**1,931**	**130**	**518**	**5,614**	**9,996**	**37,946**	**2,075**	**20.76**	**1,980**	**19.81**	**43**	**3**	**-**
1	Cam Nhuong	21	7	278.3	32.6	15.0	5.6	12.0	245.7	2,661	11,000	579	21.76	269	10.11	13		
2	Thien Cam	22	9	1,401	618.8	365.7	50.0	203.2	782.5	1,305	4,939	267	20.46	221	16.93	8		

3	Cam Phuc	21	8	794	392.7	276.1	72.2	44.4	401.2	1,025	3,999	245	23.90	316	30.83	1	1	
4	Cam Thanh	21	4	1,098	640.4	539.8	2.2	98.5	457.9	1,938	7,189	326	16.82	444	22.91	10	1	
5	Cam Lac	23	7	3,879	543.3	439.8	0.0	103.5	3,335.7	1,821	6,357	414	22.73	386	21.20	3		
6	Cam Vinh	21	11	742	351.0	294.9	-	56.1	391.4	1,246	4,462	244	19.58	344	27.61	8	1	
VIII	**Loc Ha**	**114**	**24**	**4,392**	**2,675**	**1,764**	**55**	**856**	**1,717**	**5,478**	**19,209**	**1,175**	**21.45**	**1,004**	**18.33**	**13**	**9**	**0**
1	Tan Loc	37	7	1,263	760.7	504.1	-	256.6	502.7	1485	5486	407	27.41	255	17.17	3	3	
2	Hong Loc	40	10	2,116	1,203.7	627.6	0.0	576.1	912.6	2174	7560	484	22.26	356	16.38	2	3	
3	Thach My	37	7	1,012	710.5	632.0	55.0	23.6	301.9	1819	6163	284	15.61	393	21.61	8	3	
IX	**Ky Anh**	**53**	**8**	**6,772**	**4,394**	**1,514**	**117**	**2,763**	**2,377**	**5,611**	**18,838**	**1,224**	**21.81**	**800**	**14.26**	**10**	**2**	**0**
1	Ky Van	18	3	2,363	1,798.7	751.8	13.2	1,033.7	564	1,856	6,147	355	19.13	195	10.51	2		
2	Ky Xuan	18	2	2,288	1,639.7	317.8	0.0	1,321.9	648	1,882	6,464	452	24.02	321	17.06	2	2	
3	Ky Giang	17	3	2,121	955.7	444.3	103.8	407.6	1,165	1,873	6,227	417	22.26	284	15.16	6		
X	**Nghi Xuan**	**65**	**21**	**2,754**	**2,172**	**1,747**	**117**	**308**	**583**	**3,872**	**13,712**	**799**	**20.6**	**1,521**	**39.3**	**17**	**3**	**0**
1	Xuan Hai	22	7	556	418.4	326.1	21.5	70.8	137.2	1,141	4,343	182	15.95	422	36.99	6		
2	Xuan My	21	7	1,128	919.6	761.4	31.1	127.1	208.8	1,030	3,498	126	12.23	493	47.86	7	1	

3	Xuan Lien	22	7	1,070	833.5	659.4	64.3	109.8	236.8	1,701	5,871	491	28.87	606	35.63	4	2	
50		**1,104**	**310**	**93,659**	**66,237**	**21,334**	**873**	**44,030**	**27,422**	**60,103**	**209,604**	**12,783**	**21.27**	**12,330**	**20.51**	**160**	**76**	**13**

Criteria for assessing proposals:

1	Prioritizing communes with high poverty and near-poverty rates in comparison with provincial poverty rate (in 2011)
2	Districts and communes which are neighboring and similar to land conditions, agriculture production, and customs
3	Prioritizing communes with high frequency of natural disasters and floods in the region
4	Taking some old communes in IMPP as core ones for sustainable rural development via collaborative economy
5	Considering priority orders of communes proposed by districts to be supported by IFAD
6	Prioritizing communes without potential
7	Prioritizing potential communes that remain poor

Annex 5: Timeline of climate hazards in Quang Binh and Ha Tinh

Hiền Ninh Commune		Quang Chau Commune		Quang Thach Commune	
Decade	**Year / Event**	**Decade**	**Year: Event**	**Decade**	**Year: Event**
1960s	1968: extreme cold	1960s		1960s	
1970s		1970s		1970s	
	1972: flood		1977: storm and flood		
	1976: extreme cold				
	1978: extreme drought and flood				
1980s		1980s		1980s	
	1980: extreme cold		1980: storm		
	1983: storm and flood		1987: huge storm		1987: huge storm
	1985: storm and flood				
1990s		1990s		1990s	
	1990: extreme cold		1993: drought		
	1992: flash-flood		1997: drought		1997: storm
	1995: flood				
2000s		2000s		2000s	
	2003: flood		2000: flood		
			2007: storm		
			2008: drought		
2010 - present		2010-present		2010-present	
	2010: cyclones and extreme heat (42 °C)		2010: extreme cold		2010: extreme cold
	2011: flood				
	2013: huge storm		2013: huge storm		2013: huge storm
	2014: drought		2014: drought		2014: drought
	2015: drought		2015: drought		2015: drought
1970s-1980s: much more storms and floods **2000-present: less cold, less rain, less storm, less flood, hotter and stronger Lao wind**					

Cam Lac Commune	
Decade	**Year: Event**
1960s	
1970s	
1980s	
	1984: flood
1990s	
	1991: extreme cold
	1994: storm
2000s	
	2008: huge storm
	2009: heavy rain for a long time
2010 - present	
	2011: extreme cold
	2014: drought

Xuân Mỹ Commune	
Decade	**Year: Event**
1960s	
1970s	
1980s	
	1982: storm
	1989: storm and flood
1990s	
2000s	
2010 - present	
	2010: historical flood
	2013: extreme cold
	2015: drought

Xuân Liên Commune	
Decade	**Year: Event**
1960s	
1970s	
1980s	
1990s	
2000s	
2010 - present	

Synthesis		
Decade	**Year / Event**	**Place**
1960s	1968: extreme cold	Hien Ninh
1970s		
	1972: flood	Hien Ninh
	1976: extreme cold	Hien Ninh
	1977: storm and flood	Quang Chau
	1978: extreme drought and flood	Hien Ninh
1980s		
	1980: extreme cold	Hien Ninh
	1980: storm	Quang Chau
	1982: storm	Xuan My
	1983: storm and flood	Hien Ninh
	1985: storm and flood	Hien Ninh
	1987: storm	Quang Chau, Quang Thach
	1989: storm and flood	Xuan My
1990s		
	1990: extreme cold	Hien Ninh
	1991: extreme cold	Cam Lac
	1992: flash-flood	Hien Ninh
	1993: drought	Quang Chau
	1994: storm	Cam Lac
	1995: flood	Hien Ninh
	1997: storm and drought	Quang Chau and Quang Thach
2000s		
	2000: flood	Quang Chau
	2003: flood	Hien Ninh
	2007: storm	Quang Chau
	2008: drought	Quang Chau
	2008: storm	Cam Lac
	2009: heavy rain for a long-time	Cam Lac
2010 - present		
	2010: cyclones and extreme heat (42 °C)	Hien Ninh
	2010: extreme cold	Quang Chau and Quang Thach
	2010: historical flood	Xuan My
	2011: flood	Hien Ninh
	2011: extreme cold	Cam Lac
	2013: huge storm	Hien Ninh, Quang Chau and Quang Thach
	2013: extreme cold	Xuan My
	2014: drought	Hien Ninh, Quang Chau, Quang Thach and Cam Lac
	2015: drought	Hien Ninh, Quang Chau, Quang Thach and Xuan My

Annex 6: Outputs of the validation workshops in Quang Binh and Ha Tinh

Quang Binh

GROUP 1 - Quảng Thạch		
Cassava		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Variety and technique: **Farmers self-supply planting materials, leading to degeneration problems; farmers still use basic crop management practices for cassava cultivation, leading to soil degradation and soil erosion.**	Introducing **new varieties** with shorter cycle and good tolerance for climate change, pest and disease; organizing **training, communication events, and trial models** to enhance farmers' awareness and capacity in relation to cassava cultivation techniques; conducting **exchange visits** to show farmers sustainable cassava practices	CIAT, DARD at all levels, agriculture extension agencies at all levels; SRDP, Commune People's Committee, agriculture extension agencies, CIAT; CIAT, SRDP, DARD
Lack of capital/money to invest in soil rehabilitation and fertilization. After 3-5 years of cassava cultivation, soils become harder and less fertile. Farmers need to rent machines to prepare their land and make the soil softer.	**Low-interest loans**	Banks such as Policy Bank, Agriculture and Rural Development Bank, Women Development Fund
Weak linkages between farmers and factories. During peak season, a large amount of cassava is brought to factories leading to overwhelmed factories and late purchases. This results in increased production costs.	**Establish contracts** between farmers and factories (with the confirmation of Commune People's Committee) Better **coordination in relation to harvesting time** among villages and communes	Factories, Commune People's Committee

Monetary support. Lack of support for farmers, particularly during natural disasters	**Formulation of policies and strategies to support** farmers, such as those that would ensure planting material, monetary support for farmers to do large-scale field operations.	People's Committee at all levels
Bad infrastructure affects transportation costs of cassava and contributes to increased production cost	Improving the quality of roads	SRDP, People's Committee at district and provincial levels
Sweet potato		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Farmers are facing variety degeneration. Roots are very small and yields are too low.	Introduce new planting materials and new varieties with high yield and good quality and are suitable to local soil and climate conditions.	CIAT, agriculture extension agencies, DARD
Lack of market for sweet potato	Finding offtake clue?? and traders for sweetpotato Engage in animal rearing to consume local sweetpotato	Factories, businesses, SRDP
Following traditional practice that may be unsustainable and ineffective	Training course on sweetpotato cultivation techniques and exchange visits to share lessons learned from other places	CIAT, SRDP, DARD, agriculture extension agencies
Inadequate policy support	Monetary support	People's Committee at all levels
Farmers currently plant sweetpotato in small areas	Area planning for sweetpotato	Policymakers at all levels

GROUP 2- Hiền Ninh		
Cassava		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Varieties: **+ Local variety seems to be disappearing;** **+ Current cassava yield is quite low because of variety degradation;** **+ Farmers have to buy planting materials in other places**	Introduce new varieties such as KM419 with shorter cycle (6 months) and higher yield	Factories, such as those in Long Giang; + DARD, Agriculture Extension; + SRDP; +NGOs and organizations such as RDPR
Low starch content in cassava	Conduct experimental research and build models in order to increase yield (for instance, providing more fertilizers)	SRDP, agriculture extension agencies
Low price due to lack of negotiation with traders	Link farmers together and establish collaborative groups; Build capacity of farmers to negotiate, link to markets, and organize	Farmers' Union, SRDP, NGO (RDPR)
Preserving/storing and processing cassava after harvest	Train farmers on preservation and processing Invest in new machine and equipment related to storing and processing cassava	CIAT, CIP, SRDP, agriculture extension agencies
Sweetpotato		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Varieties **+ Small roots and low yield;** **+ Lack of information and access to new varieties**	Build models to introduce new varieties and transfer techniques	SRDP Agriculture extension Farmers' Union RDPR in Quang Ninh Companies such as Long Giang CIAT, CIP

Techniques: **+ Lack of techniques to improve quality and yield. Traditional practices and habits mainly used** **+ Lack of storage/preservation techniques;** **+ No techniques related to processing into delicious products (such as Khoai Gieo)**	Training on intensive farming, preservation and processing (for products such as starch, khoai gieo, dried sweetpotato, etc.)	
Lack of market opportunities (low price, sell only small amounts)	Build linkages between farmers and factories/businesses/markets	

GROUP 3- Quảng Châu		
Cassava		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Varieties	Conduct research and introduce new varieties with high starch and yield	DARD, SRDP, FoodSTART+
Techniques	Training and guidelines on cassava cultivation Set up trial models	Agriculture extension, FoodSTART+
Climate	Establish appropriate crop calendar for cassava	DARD
Market	Improve linkages among farmers and between farmers and markets Sign contracts with factories	FoodSTART+, factories
Capital/money	Low-interest loans	Agriculture and Rural Development Bank Credit fund
Machine for soil preparation	Invest in machinery	DARD, Department of Science and Technology
Transportation	Improving roads from fields to factories	SRDP
Sweetpotato		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Variety	Conduct research and introduce new varieties with high yield and quality	DARD, FoodSTART+
Technique	Training, guidelines and models	Agriculture extension, FoodSTART+
Pests and diseases	Design preventive measures such as IPM (varieties, practices, season, etc.)	FoodSTART+
Markets	Product diversification. Search for ways to process new products. Establish the linkage between producers and markets.	Factories, DOIT
Climate and weather	Build appropriate crop calendar	DARD

Ha Tinh

GROUP 1 - Nghi Xuân		
Cassava		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Lack of market	Create linkage among farmers/cassava producers Link farmers/producers with companies Find new markets	CIAT, SRDP Relevant agencies People's Committee at all levels Companies
Lack of high-quality varieties	Develop new varieties with high yield and quality Provide planting materials for farmers	CIAT, SRDP Department of Science and Technology Centre for Science and Technology Application
Lack of investment capital/money	Low-interest loans	Banks, credit fund
Constraints to pre-processing, processing, and postharvest storage	Technical training for farmers Invest in equipment for pre-processing and storage	SRDP New Rural Programme
Sweetpotato		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Variety	Invest in new varieties with high yield and quality	Variety providers, companies and research centers CIAT, SRDP, relevant agencies
Lack of markets	Establish collaborative groups Establish linkages between producers and markets Train farmers to acquire marketing skills	Companies, DOIT
Pre-processing and processing after harvest	Invest in developing techniques Training for farmers	Department of Science and Technology and New Rural Programme

GROUP 2 - Cẩm Xuyên		
Cassava		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Lack of markets	Find new markets for cassava	FoodSTART+, DARD, People's Committee at all levels, Commune agricultural cooperatives
Low economic profit due to long-growth cycles, low yield, and main use of the crop for animal feed	Find/introduce new varieties with high economic benefit (shorter cycle, higher yield and quality); Consider alternatives to other crops such as forages for animal feeding	DARD, People's Committee at all levels
Lack of linkage between producers and markets	Establish collaborative groups and linkages between farmers and markets Develop a cassava value chain	
Lack of techniques related to cultivation, processing, and marketing	Training	DARD, Farmers' Union
Sweetpotato		
PROBLEM	**SOLUTIONS**	**ORGANIZATIONS**
Variety degradation leading to very **small (or no) roots. Low profit**	Provide good planting materials and varieties	People's Committee at district and commune levels Farmers' Union Vietnam Field Crops Research Institute
No plan and techniques for sweetpotato plantation	Draft an agricultural plan for sweetpotato Training on sweetpotato cultivation techniques	People's Committee at district and commune levels Centre for Science and Technical Application
Sweetpotato fields become grazing ground of livestock	Build barriers; provide capital/money	
Sweetpotato not a priority in Ha Tinh	Engage in animal rearing that uses sweetpotato	Provincial People's Committee

The International Potato Center (known by its Spanish acronym CIP) is a research and development organization with a focus on potato, sweetpotato, Andean roots and tubers. CIP is dedicated to delivering sustainable science-based solutions to the pressing world issues of hunger, poverty, gender equity, climate change, and the preservation of our Earth's fragile biodiversity and natural resources.

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The International Center for Tropical Agriculture (CIAT) develops technologies, methods, and knowledge that better enable farmers, mainly smallholders, to enhance eco-efficiency in agriculture by making production more competitive and profitable as well as sustainable and resilient through economically and ecologically sound use of natural resources and purchased inputs.

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The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a broad alliance led by the International Potato Center (CIP) jointly with Bioversity International, the International Center for Tropical Agriculture (CIAT), the International Institute for Tropical Agriculture (IITA), and CIRAD in collaboration with research and development partners. The shared purpose is to tap the underutilized potential of root, tuber and banana crops for improving nutrition and food security, increasing incomes and fostering greater gender equity, especially among the world's poorest and most vulnerable populations

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